Matrices of Co-occurrences of Fish Species on the Scotian Shelf and in the Bay of Fundy

J. S. Scott

Biological Station
St. Andrews, N.B. E0G 2X0

November 1987

Canadian Technical Report of
Fisheries and Aquatic Sciences
No. 1581

Fisheries and Oceans Pêches et Océans

Canada

88-01710/

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1–456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457–714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715–924 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Technical Report of
Fisheries and Aquatic Sciences 1581

November 1987

MATRICES OF CO-OCCURRENCES OF FISH SPECIES ON THE SCOTIAN SHELF AND IN THE BAY OF FUNDY

J. S. Scott
Marine Fish Division
Biological Sciences Branch
Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B. EOG 2X0
Canada

This is the one hundred and ninety-fifth Technical Report from
the Biological Station, St. Andrews, N. B.

©Minister of Supply and Services Canada 1987

Cat. No. Fs 97-6/1581E ISSN 0706-6457

Correct citation for this publication:

Scott, J. S. 1987. Matrices of co-occurrences of fish species on the Scotian Shelf and in the Bay of Fundy. Can. J. Fish. Aquat. Sci. 1581: iii + 54 p.

ABSTRACT

Scott, J. S. 1987. Matrices of co-occurrences of fish species on the Scotian Shelf and in the Bay of Fundy. Can. Tech. Rep. Fish. Aquat. Sci. 1581: iii + 54 p.

The results of annual groundfish research trawling surveys of the Scotian Shelf and Bay of Fundy in the summers of 1970-79 and in spring, summer and autumn 1980-84 provide numbers of co-occurrences in the catches of the principal fish species of the area. These data are presented in the form of matrices by sub-area and season. Original numbers of co-occurrences were grouped and considered for production of graphic matrices for detailed analyses. The effect of change of species order in the matrices: by systematic group and by order of preference by bottom type, depth and site type was examined and depth selected as the criterion giving the best resolution of species assemblages. Alternative means of considering co-occurrences are presented including (i) matrices of actual numbers, (ii) graphic matrices of standardized numbers, (iii) matrices of percentage co-occurrences of each species in the catches of others, (iv) tables of co-occurrence indices.

Initial examination of the matrices shows that co-occurrences are dominated by the major groundfish species such as cod, thorny skate and haddock. The Bay of Fundy is distinct from other areas, with significant associations of shallow water species but notably low representations of deepwater species, while Sydney Bight, with generally low degrees of association, shows the opposite. Comparison of seasonal co-occurrences reveals changes in species such as spiny dogfish, pollock and silver hake which may be related to seasonal movements. Details of associations of each species are presented.

RÉSUMÉ

Scott, J. S. 1987. Matrices of co-occurrences of fish species on the Scotian Shelf and in the Bay of Fundy. Can. Tech. Rep. Fish. Aquat. Sci. 1581: iii + 54 p.

Entre 1970 et 1979 (pendant l'été) et entre 1980 et 1984 (printemps, été et automne), on a procédé, au moyen de chaluts, à des études annuelles du poisson de fond dans la Plate-forme Scotian et la baie de Fundy. L'étude portait sur le nombre de cooccurences des principales espèces du secteur dans les prises. Les données sont présentées dans des matrices établies par sous-secteur et par saison. Les premiers relevés de cooccurences ont été regroupés et inscrits dans des matrices graphiques aux fins d'analyses détaillées. On a examiné les changements dans l'ordre des espèces figurant aux matrices : par groupe systématique et par ordre de préférence selon le genre de fond, la profondeur de l'eau et le genre d'emplacement. La profondeur de l'eau a été choisie comme le critère permettant le mieux de déterminer les regroupements d'espèces. Le présent rapport donne d'autres moyens d'étudier les cooccurences, notamment: i) l'établissement de matrices des nombres de cooccurences réelles; ii) l'établissement de matrices graphiques des nombres normalisés; iii) l'établissement de matrices donnant la cooccurence de chaque espèce, en pourcentage, dans les prises d'autres espèces; iv) l'établissement de tableaux des indices de cooccurence.

Un examen initial des matrices révèle que l'incidence des cooccurences est plus fréquente parmi les principales espèces de poisson de fond telles la morue, la raie radiée et l'aiglefin. La baie de Fundy se distingue des autres secteurs car on y retrouve un grand nombre de regroupements d'espèces d'eau peu profonde tandis que les espèces de grand fond se regroupent très peu. Par ailleurs, les études effectuées dans la Sydney Bight, où les degrés de regroupement sont généralement peu élevés, prouvent contraire. La comparaison des cooccurences saisonnières révèle des changements au niveau des espèces telles l'aiguillat commun, la goberge et le merlu argenté, ces changements pouvant être attribuables aux mouvements saisonniers. Le rapport décrit en détail les regroupements de chaque espèce.

INTRODUCTION

Standard summer bottom-trawl surveys (Halliday and Koeller 1981) of the Scotian Shelf and Bay of Fundy have been carried out annually by the Marine Fish Division, Dept. of Fisheries and Oceans, since 1970 and seasonal (March and October) surveys from 1980 to 1984, inclusive. The wealth of data collected on the surveys provides the basis for extensive biological studies as well as for stock assessment purposes. With the exception of publications largely based on cluster analysis (Mahon et al. 1984; Mahon 1985; Mahon and Sandeman 1985), however, the data have not been used in relation to species association, nor have they been presented in a form which allows comparison of associations of individual species or of species assemblages simply by area and season, as distinct from the site-type approach used by Mahon et al. (1984).

This study presents original co-occurrence data on the principal fish species of the Scotian Shelf and Bay of Fundy in the form of matrices. It also examines some alternatives for further treatment. Detailed analysis of the associations of each species is given in relation to spatial and temporal change and factors which may influence the associations. The data is the subject of ongoing work but the basic data is made available here for use by others who may find them useful in relation to their own special studies, either on species association or on multispecies fisheries.

MATERIALS AND METHODS

Each annual trawl survey was planned as approximately 150 ½-hr fishing sets, randomly selected on a depth-stratified sampling design (Halliday and Koeller 1981). Factors such as weather, ice-conditions and vessel problems affected the number of sets completed. A total of 3,739 sets, comprising 1,486 in the 1970-79 summer series and 697,748 and 808 in the spring, summer and autumn, respectively, of the 1980-84 series was actually made (Table 1). The catch from each set was sorted by species and weights, numbers and various biological data were recorded. All catches for the summers (July) of 1970-79 and the spring (March), summer (July) and autumn (October) catches for the years 1980-84 were aggregated separately and the number of times when one species occurred with another was calculated by area and season. The areas selected were: Bay of Fundy, southwest Scotian Shelf (Northwest Atlantic Fisheries Organization (NAFO) Division 4X excluding the Bay of Fundy), central Scotian Shelf (NAFO Div. 4W), northeast Scotian Shelf (NAFO Subdiv. 4Vs), Sydney Bight (NAFO Subdiv. 4Vn) (Fig. 1).

The co-occurrence data were assembled in a number of ways. The actual numbers of co-occurrences were tabulated in the form of matrices (Tables 2-21) for area and season. Co-occurrences were then expressed as percentages for each matrix and, by trial and error, grouped into ranges of percentages: 0, 1-9, 10-24, 25-49, 50-100. These ranges were chosen as the 'best' groupings, based on distinction of different degrees of association in the matrices. The species order in the matrices was arranged: 1) by species group (gadids, flat fishes, skates, etc.); 2) by bottom type (Scott 1982a); 3) by the order of Mahon et al. (1984) based on proportion of years in which species occurred in the same group (derived by cluster analysis based on a combination of factors including depth, bottom type, temperature and salinity) and 4) by depth preference (Scott 1982b). A subset of graphic matrices for 1970-79 summer surveys in Div. 4X excluding the Bay of Fundy was prepared in these four different orders. These matrices were then compared to select the order which appeared to give the most clearly defined assemblages of species (Fig. 2). Order by depth preference was selected. Graphic matrices were then prepared for all area and season combinations (Fig. 3).

In Tables 2-21, the numbers composing the diagonal line at the bottom right of each table are the actual number of occurrences of each species. From these and the number of co-occurrences of each species pair which appears in the body of each of these tables, the percentage of sets in which each species occurred with every other was calculated (Tables 22-41). The rows give the percentage of sets in which the indicated species occurred with the species in the columns, e.g. from Table 22, cod occurred in 95% of tows in which there were white hake; white hake in 80% of tows in which there were cod.

In addition to the numerical and graphic matrices, a table of indices of co-occurrence was produced (Table 42). These were based on allocation of points to each species, by area and season, on an arbitrary scale determined by the groupings used in the graphic matrices of co-occurrences: 0 = 0; 1-10 = 1; 11-24 = 2; 25-49 = 3; 50-100 = 5. The index for each species was calculated by summing the point ratings for all co-occurrants for areas and seasons.

RESULTS AND DISCUSSION

The matrices give a concise presentation of an extensive set of data. Comparison of 1970-79 summer data (Tables 2-6) and 1980-84 summer data (Tables 12-16) showed a high degree of correspondence in patterns of association of species between the two periods for all areas and indicated that the 1980-84 data may be used as representative of the whole survey period. On that basis, it is assumed that the 1980-84 spring and autumn data are also applicable to the whole period 1970-84.

Cursory examination revealed obvious differences between areas, particularly between the Bay of Fundy (e.g. Table 7) and the Scotian Shelf (e.g Tables 8-10) and showed the relative impoverishment of the Sydney Bight area in terms of species association (e.g. Table 11). Seasonal changes in each area are less obvious but comparison of matrices showed increased degrees of association in species such as spiny dogfish in summer (e.g. Fig. 3) and silver hake in autumn (e.g. Fig. 3) in some areas. These, and similar changes in other species, appear to reflect seasonal movements of the fish.

Indices of co-occurrence (Table 42) facilitate identification of species with notably high or low characteristic degrees of association in relation to geographic area and season, and confirm geographic and seasonal changes noted in the matrices. Again, they show the importance of the cod-haddock-thorny

skate assemblage and the relative low levels of co-occurrence in the Sydney Bight area (4Vn) in comparison to the other areas examined.

The order in which species are listed governs how species assemblages will be shown in the matrices. It is logical to base the order on some biological criterion which would influence associations between species. The four methods examined (Fig. 2) are logical but systematic order (related species grouping) produced the poorest resolution of assemblages (Fig. 2A). This may be explained by niche diversity resulting in lower associations of related species than are effected by common preferences for environmental factor(s). Bottom type (Fig. 2B) yielded good resolution but had to be abandoned as there was no information available for several species. There was little to choose between the orders by depth preference (Fig. 2C) and by the order of Mahon et al. (1984) (Fig. 2D). The final choice, depth preference, was based on the higher degree of clustering of strong co-occurrants along the diagonals of the matrices in the former order.

An essential difference between the present treatment and that of Mahon et al. (1984) is that the latter authors identified site types, some of which were common to widely separated areas but which had certain characteristics in common, such as limited depth range, or bottom type, temperature and salinity. The present treatment is based on geographic area, irrespective of other factors. Choosing depth preference for species order in the matrices does introduce depth as the major determinant of assemblages, a choice which is supported by other studies (Fager and Longhurst 1968; Gabriel and Tyler 1980; Colvocoresses and Musik 1984). It also reduces the effect that great ranges of depth in some areas might have if some other single criterion were chosen. For instance, in the central part of the Scotian Shelf, depths sampled in the surveys ranged from about 20 fath (37 m) on the banks to about 120 fath (220 m) in the basins and up to 200 fath (366 m) on the Shelf slope.

The degrees of co-occurrence are evidently dictated by dominant species (Fig. 3). This is evidenced by cod and thorny skate, in particular, in all areas, by haddock on the southwest and central parts of the Shelf and by shallow-water species in the Bay of Fundy.

Tables of percentage co-occurrence (Tables 22-41) detail the frequency in which each species occurs in catches of others, not simply the number of times which they occur together. The data facilitate identification of dominant species in co-occurrences. For instance, in Table 27, winter flounder, sand lance, wolffish, ocean pout and eelpout occurred at levels of $\leq$33% with other species but cod, a dominant species, occurred at levels of 50-100% in catches in which these species occurred (and with all other species listed except longfin hake, grenadier and white hake). The co-occurrence indices (Table 42) are measures of dominance and afford a ready means of comparing individual species and also the geographic and seasonal changes in associations. Detailed examination of the associations of each species follows:

Angler (Lophius americanus) occurs over a wide depth range (Scott 1982b) but showed no special affinity for any other species (Fig. 3) and could not be identified with any particular assemblage. It was associated with the mid-depth category rather than with the shallow- and deep-water fishes. Its co-occurrence indices in the Bay of Fundy were low in spring but moderate in summer and autumn, whereas in other areas there was little seasonal variation. The indices increased from the Bay of Fundy to 4W, then decreased to 4Vn (Table 1).

Argentine (Argentina silus) is part of the deep-water assemblage (Scott 1982b), associated particularly with silver hake (Fig. 3B, C) but it co-occurred commonly with redfish, white hake, witch flounder, plaice and angler. It also occurred with the cod-haddock-thorny skate assemblage but this association was weak. It was virtually absent from the Bay of Fundy but appeared there in summer, very weakly associated with a large range of other species (Fig. 3A). Similarly, it was poorly represented in 4Vn, absent in spring but weakly associated with mid-depth and deep-water fishes in summer and autumn (Fig. 3E). Co-occurrence indices declined from spring to autumn in 4X, 4W and 4Vs but summer values were higher than in other seasons in the Bay of Fundy and 4Vn. The indices increased along the Shelf from 4X to 4Vs but were notably low in the Bay of Fundy and 4Vn (Table 1).

Cod (Gadus morhua) was, generally, the dominant species in associations of fishes in the survey area (Fig. 3, Table 1). Co-occurrences with almost all mid- to shallow-water species were strong and were moderate with deep-water species, particularly argentine and redfish in 4X, 4W and 4Vs, and longfin hake, redfish and grenadier in 4Vn. It was associated at greater or lesser degree with all other species considered here.

The strongest associations varied both with area and season (Fig. 3). In the Bay of Fundy (Fig. 3A), the strong assemblage, cod-ocean pout-sea raven-thorny skate-longhorn sculpin-witch flounder persisted throughout the year. Haddock, spiny dogfish and white hake joined the group for summer and autumn and herring was closely associated in spring only.

In 4X (Fig. 3B) haddock, and in 4W (Fig. 3C) haddock, thorny skate and plaice were the only species closely associated with cod throughout the year, while plaice and pollock were strongly associated in spring only.

Plaice and thorny skate were the major co-occurrents with cod throughout the year in 4Vs and 4Vn (Fig. 3D, E) although the association with thorny skate appeared less strong in spring in 4Vn (Fig. 3E). Witch flounder, pollock and white hake were seasonally important, with pollock strong in spring as in 4X. The matrices (Fig. 3E) indicate a shift in associations from the shallow-water fishes in spring to deep-water species in summer and autumn. Co-occurrence indices had higher spring values than those of other seasons in all areas except the Bay of Fundy but, geographically, there was little variation except for the high value, again in the Bay of Fundy (Table 1).

Cusk (Brosme brosme) showed notable associations with other species in 4X only (Fig. 3B) but had no really strong co-occurrences. In spring, it co-occurred at moderate levels with cod, haddock, plaice, pollock and silver hake but the number of significant associations decreased during the year.

It was absent from 4Vn. There was little seasonal variation in co-occurrence indices, with a slight reduction in summer in the Bay of Fundy and a higher spring level in 4X. The indices decreased along the Shelf from 4X to 4Vn but were relatively low in the Bay of Fundy (Table 1).

Eelpout (Lycodes reticulatus) had no significant association with any other species. It co-occurred at low levels with most species in some area at some season (Fig. 3). Co-occurrence indices were low with no evident seasonal pattern but there was a general decrease from the Bay of Fundy to 4Vn (Table 1).

Grenadier (Nezumia bairdii) is a member of the deep-water fish assemblage associated mainly with witch flounder, white hake, redfish and longfin hake and, to a lesser degree, with cod, plaice and thorny skate (Fig. 3). It was absent from the Bay of Fundy (Fig. 3A) and showed low levels of co-occurrence in other areas with species other than those noted above, mainly in the mid-depth group (Fig. 3B-E). Co-occurrence indices showed little seasonal variation except in 4Vn where it was absent in spring but present in fairly high levels in summer and autumn (Fig. 3E). Geographically, the indices increased from zero in the Bay of Fundy along the Shelf to a moderate level in 4Vs, then fell in 4Vn (Table 1).

Haddock (Melanogrammus aeglefinis) was closely associated with cod in all areas and its associations with other species were similar to those of cod but to a lower degree in some cases (Fig. 3). In the Bay of Fundy, there were no really strong co-occurrences in spring but haddock occurred with almost all other species except the deep-water group. In summer, however, the associations strengthened and were virtually the same as for cod, i.e. strong co-occurrence with white hake, spiny dogfish, thorny skate, cod, sea raven, longhorn sculpin and winter flounder. By autumn, all but cod and white hake had disappeared from this group, although they still appeared in weaker association, but the silver hake association strengthened (Fig. 3A).

In 4X (Fig. 3B) and 4W (Fig. 3C), haddock associations were the same as for cod, with plaice and cod important in all seasons in both areas, thorny skate strong in all seasons in 4X and pollock and silver hake moderately important in 4X in spring and in 4X and 4W in fall. Somewhat stronger associations were shown by haddock than by cod with plaice and silver hake in 4X and 4W, respectively (Fig. 3B, C).

Haddock associations in 4Vs (Fig. 3D) and 4Vn (Fig. 3E) were comparatively weak. The fish co-occurred with much the same species as cod, to a lesser degree, but it was still one of the more significant components in assemblages in those areas. In 4Vn (Fig. 3E), it was associated with the mid-depth group almost to the exclusion of the deep-water fishes. Notable seasonal changes in co-occurrence indices were shown by higher values in summer in the Bay of Fundy, in spring in 4Vs and in autumn in 4Vn and a lower summer value in 4X. Average values of the indices were high from the Bay of Fundy to 4W, then fell to moderate levels in 4Vs and 4Vn (Table 1).

Halibut (Hippoglossus hippoglossus) was associated mainly with the shallow- and mid-depth fishes and showed weak co-occurrence with the deep-water group (Fig. 3). It was not strongly associated with any species. In the Bay of Fundy, it was moderately associated with most of the fishes which occur there, particularly longhorn sculpin and cod (Fig. 3A) but, by summer, the associations had weakened and this still persisted through autumn. In 4X-W-Vs (Fig. 3B, C, D), halibut was associated mainly with the cod-haddock-thorny skate group at all seasons, with wolffish entering the association in all seasons in 4X and in spring in 4Vs. It was absent from 4Vn in spring and summer and with only weak associations there in autumn (Fig. 3E). The fish's strongest associations appeared to be with cod in spring in the Bay of Fundy and 4X and with haddock throughout the year in 4X. Co-occurrence indices were moderate in spring in the Bay of Fundy, 4X and 4W but fell off in summer and autumn. They remained stable at all seasons in 4Vs but in 4Vn rose from zero in spring and summer to a low level in autumn. There was little geographic variation in the indices except for a relatively low value in 4Vn (Table 1).

Herring (Clupea harengus) was associated with all other species at moderate to low degrees at one or other area or season. The most significant co-occurrences were in the Bay of Fundy and, to a lesser extent, 4X, then diminishing along the Scotian Shelf to 4Vs, but increasing in 4Vn (Fig. 3). In the Bay of Fundy in spring (Fig. 3A), there were strong associations with winter flounder, sea raven and cod and moderate associations with most other species listed. The strength of co-occurrences decreased through the summer to autumn but those with shallow-water species and with the cod-haddock-thorny skate assemblage persisted at moderate levels. The pattern in 4X (Fig. 3B) and 4W (Fig. 3C) was similar to that of the Bay of Fundy but in 4Vs (Fig. 3D) associations were uniformly low. In 4Vn (Fig. 3E), co-occurrences with shallow-water species were low but herring was associated with cod and thorny skate at moderate levels thoughout the year, with plaice in summer and with plaice and haddock in autumn. Indices of co-occurrence decreased from spring to autumn in all areas except 4Vn where they rose in autumn. They decreased from the Bay of Fundy to 4Vs but rose again in 4Vn (Table 1).

Little skate (Raja erinacea) showed significant levels of co-occurrence with other species in the Bay of Fundy only, and mainly with the shallow-water group (Fig. 3A). It was poorly represented in 4X (Fig. 3B) and associations diminished further to the northeast until it was absent in 4Vn (Fig. 3E). In the Bay of Fundy (Fig. 3A), it was most strongly associated with winter flounder, longhorn sculpin, sea raven and cod throughout the year and with silver hake in autumn. It co-occurred seasonally with several other species at moderate levels, notably haddock in summer and thorny skate, spiny dogfish, white hake and silver hake in summer and autumn. Co-occurrence indices showed little seasonal change except in 4X where there was a marked increase from spring through summer to autumn and in 4W where there was a corresponding decrease. The indices decreased continuously from the Bay of Fundy to 4Vn (Table 1).

Longfin hake (Phycis chesteri) was weakly associated with most other species in some season or area (Fig. 3). It co-occurred to a significant degree with members of the deep-water group only, most strongly with witch flounder, redfish and

grenadier in 4Vn (Fig. 3E). From virtual absence in the Bay of Fundy, its associations increased along the Shelf to the northeast, with cod, thorny skate and plaice in addition to the deep-water fishes. There was no general seasonal pattern of change in the associations. Co-occurrence indices (Table 1) showed changes from zero in spring and summer to a low level in autumn in the Bay of Fundy, and from zero in spring to moderate levels in summer and autumn in 4Vn. Geographical comparison showed a general trend of increase along the Shelf from 4X to 4Vs with lower levels in the Bay of Fundy and 4Vn.

Longhorn sculpin (Myoxocephalus octodecemspinosus) co-occurred most strongly with the shallow- and mid-depth fishes. Levels of association were strongest in the Bay of Fundy, diminishing along the Shelf to the northeast (Fig. 3). In the Bay of Fundy (Fig. 3A), it was most frequently associated with winter flounder, sea raven, cod and thorny skate at all seasons, with white hake and haddock in summer and with white hake, silver hake and spiny dogfish in autumn. In 4X (Fig. 3B) and 4W (Fig. 3C), its associations had weakened considerably, with co-occurrences at moderate levels with cod, plaice, thorny skate and haddock only in spring, cod and haddock in summer and with cod, haddock, thorny skate and silver hake in autumn. A similar pattern held in 4Vs (Fig. 3D) but without silver hake as a significant associate. In 4Vn, there were a few weak associations only (Fig. 3E). There was little seasonal change in co-occurrence indices in any area but there was a notable geographical decrease from the Bay of Fundy to 4Vn (Table 1).

Mackerel (Scomber scombrus) was associated to some degree with all other species considered here, at some season or in some area (Fig. 3), but the only notable associations were in the Bay of Fundy in autumn with the shallow-water longhorn sculpin and sea raven, the ubiquitous cod and silver hake and white hake (Fig. 3A). It was missing in spring from the Bay of Fundy, 4Vs and 4Vn but persisted in summer and autumn in all areas, associated with shallow-water to deep-water species. Co-occurrence indices (Table 1) increased from zero in spring to a maximum in autumn in the Bay of Fundy, 4Vs and 4Vn, but showed a summer low in 4X and showed little seasonal change in 4W. Geographically, the indices increased from the Bay of Fundy to 4W, then decreased through 4Vs to 4Vn.

Ocean pout (Macrozoarces americanus) co-occurred with all other species but most closely with the mid-depth group, cod-haddock-thorny skate, in all areas (Fig. 3). The strongest associations were in the Bay of Fundy (Fig. 3A) where, in spring, it matched those of cod with both shallow- and mid-depth fishes. The associations weakened in summer and autumn but still remained among the strongest. Degree of co-occurrence weakened from the Bay of Fundy along the Scotian Shelf to the northeast with a tendency away from the shallow-depth group to the mid-depth group, and with weak associations with the deep-water group, particularly redfish. Indices of co-occurrence showed little seasonal variation in all areas but showed a consistent decrease from the Bay of Fundy to 4Vn (Table 1).

Plaice (Hippoglossoides platessoides) was associated with all species, in all depth groups, and with most to at least a moderate degree (Fig. 3). It co-occurred to a high degree with cod in all areas, with haddock in 4X and 4W, with thorny skate in 4W, 4Vs and 4Vn, with witch flounder in 4Vs, and with white hake in 4Vn. In the Bay of Fundy (Fig. 3A), in spring, it was strongly associated with the shallow-water winter flounder-longhorn sculpin- sea raven assemblage and with the mid-depth cod-thorny skate group. These associations, and others in the area, weakened greatly through summer and autumn but there was a concommitant strengthening of the association of plaice with silver hake and white hake. Co-occurrences with the shallow-water group diminished progressively from the Bay of Fundy to 4Vn and the mid- and deep-water groups became relatively more important. There were few notable seasonal changes in degree of co-occurrence on the Shelf. In 4X (Fig. 3B), there was a weakening of the spring associations during summer and autumn but that with haddock was maintained. In 4W (Fig. 3C), there was increased association of plaice with silver hake in autumn. In 4Vn (Fig. 3E), the association with cod remained strong at all seasons but that with thorny skate increased from spring through summer and autumn, witch flounder increased in summer but decreased in autumn and white hake strengthened in autumn. Co-occurrence indices (Table 1) decreased notably from spring to autumn in the Bay of Fundy and 4X, remained fairly steady in 4W and 4Vs and increased in 4Vn. Geographically, the indices were fairly constant except for a relatively low value in 4Vn.

Pollock (Pollachius virens) had no strong associations except with cod and haddock in spring in 4X but co-occurred with all other species to some degree (Fig. 3). In the Bay of Fundy, it was moderately associated with most of the shallow- and mid-depth fishes in spring and summer but the relationships weakened considerably in autumn (Fig. 3A). In 4X, pollock co-occurred mainly with the mid-depth group but extended to the deep-water group, strongly in spring, but weakened considerably with most species in summer and autumn (Fig. 3B). The only notable associations in 4W were with cod, haddock and silver hake in spring (Fig. 3C). These diminished in summer but the haddock and silver hake associations increased again in autumn. In 4Vs (Fig. 3D) and 4Vn (Fig. 3E), co-occurrences were generally weaker than in 4W but followed the same pattern as in 4W. The association with cod in spring in 4Vn was strong and moderate with witch flounder, white hake and redfish. Indices of co-occurrence (Table 1) showed high spring values from 4X to 4Vn but 4Vn had a low summer value. In the Bay of Fundy, similar spring and summer values were followed by a low autumn level. Geographically, values decreased from the Bay of Fundy and 4X along the Shelf to 4Vn.

Redfish (Sebastes spp.) is typically a deep-water fish (Scott 1982b). This was borne out in the matrices where, except in the Bay of Fundy, it was almost exclusively associated with the mid-depth and deep-water species (Fig. 3). It showed no special affinity for any species in the Bay of Fundy but in 4X it was moderately associated with the cod-haddock-thorny skate group, and with plaice, pollock, silver hake and white hake (Fig. 3B). In 4W, the associations with cod and haddock had weakened but that with plaice persisted and those with witch flounder and silver hake strengthened (Fig. 3C). In 4Vs (Fig. 3D) and 4Vn (Fig. 3E), the cod-thorny skate association was renewed, together with plaice and witch flounder, and with white hake as a major co-occurrent in autumn in 4Vn. Co-occurrence indices showed little

seasonal changes but, geographically, there was a sharp increase from the Bay of Fundy to 4X, then an erratic decrease to 4Vn (Table 1).

Sand lance (Ammodytes dubius) did not co-occur to a significant degree with any other species. Its associations were largely with species in the shallow-water group (Fig. 3), in summer only in the Bay of Fundy and autumn only in 4Vn but at all seasons elsewhere. Indices of co-occurrence were the lowest of all species examined, with values higher in summer in all areas except 4Vn. They increased steadily from the Bay of Fundy to 4Vs, then fell in 4Vn (Table 1).

Sea raven (Hemitripterus americanus) was restricted in associations with other species almost wholly to the shallow-water group, except in the Bay of Fundy (Fig. 3). There it was strongly associated with winter flounder and longhorn sculpin, as well as with the cod-haddock-thorny skate assemblage, and with ocean pout and plaice in spring, white hake in summer and spiny dogfish, silver hake and white hake in autumn (Fig. 3A). Its associations, even with the shallow-water group, diminished rapidly from the Bay of Fundy to 4X where it was weakly associated with longhorn sculpin, the cod-haddock-thorny skate group and wolffish, with some emphasis on haddock in autumn (Fig. 3B). The decrease continued through 4W and 4Vs but in 4Vn in spring it was moderately associated with thorny skate, smooth skate and redfish (Fig. 3E). There was little seasonal variation in co-occurrence indices except for a decrease from spring to autumn in 4Vs and a low summer value in 4Vn (Table 1). The indices were high in the Bay of Fundy but fell to 4X and continued to decrease along the Shelf to 4Vn.

Silver hake (Merluccius bilinearis) is classed as a deep-water species (Scott 1982b) but, in fact, was associated closely with the mid-depth group and even to a considerable degree with the shallow-water group (Fig. 3). This is particularly obvious in the Bay of Fundy (Fig. 3A) where, in the virtual absence of deep-water species other than redfish, silver hake was strongly associated with the winter flounder-longhorn sculpin-sea raven and the cod-haddock-thorny skate assemblages. These associations were not especially notable in spring but they intensified through summer into autumn. At that time ocean pout, spiny dogfish and white hake were also strongly associated. In 4X (Fig. 3B), silver hake co-occurred strongly with haddock, and in 4W (Fig. 3C) with haddock and plaice, in autumn. Moderate degrees of co-occurrence in both 4X and 4W were mainly with cod, haddock, thorny skate, plaice, witch flounder and white hake throughout the year. Redfish was associated in 4X at all seasons and in 4W in autumn. In summer in 4W and in autumn in 4X and 4W, co-occurrences strengthened with the shallow-water species yellowtail flounder and longhorn sculpin (Fig. 3B, C). In 4Vs and 4Vn associations with other species were weak, the only notable co-occurrences being with the mid-depth and deep-water cod, thorny skate, plaice and witch flounder in 4Vs in autumn. Co-occurrence indices (Table 1) increased from spring to autumn in all areas except 4X where there was a summer minimum. Geographic comparison showed a general decrease along the Scotian Shelf from the Bay of Fundy to 4Vn.

Smooth skate (Raja senta) was not strongly associated with any other species but co-occurred mainly with the cod-haddock-thorny skate-plaice assemblage (Fig. 3). There was a lesser association with shallow-water and other mid-depth species but very weak association with the deep-water group. Co-occurrences were weak in all areas except the Bay of Fundy and 4Vn (Fig. 3A, E). In the Bay of Fundy, it was moderately associated with the winter flounder-longhorn sculpin-sea raven and cod-thorny skate assemblages as well as with ocean pout and plaice, but to a lesser degree with haddock. In 4Vn sea raven was the only co-occurrant in the shallow-water group and cod, thorny skate and plaice predominated in the associations, with witch flounder and redfish also appearing. Indices of co-occurrence (Table 1) decreased, in general, from spring to autumn in all areas except 4Vn where there was a minor peak in summer. The geographic series of values along the Shelf showed virtually no change except for a slightly higher level in the Bay of Fundy and a lower level in 4Vn.

Spiny dogfish (Squalus acanthias) co-occurrences were, in general, higher in degree in the southwest part of the Shelf and with the mid-depth group rather than otherwise. In the Bay of Fundy (Fig. 3A), it was weakly associated with a few species in spring but associations intensified greatly in summer with most species, particularly with cod and haddock. This intensification continued into autumn; haddock weakened but co-occurrences with the winter flounder-longhorn sculpin-sea raven, cod-thorny skate and white hake-silver hake groups were strong. In 4X (Fig. 3B), co-occurrences with shallow-water species were weak in spring but those with yellowtail flounder and longhorn sculpin rose in summer and autumn. It associated with most of the mid-depth and deep-water species in summer, particularly cod and haddock, but the associations weakened in autumn. In 4W spring associations were, again, mainly with mid-depth species but were weak except for haddock (Fig. 3C). In 4Vs and 4Vn, co-occurrences were negligible at all seasons. Indices of co-occurrence (Table 1) showed high summer and autumn values in the Bay of Fundy, higher spring values in 4X and 4W, little variation in 4Vs, and some presence in summer only in 4Vn. The indices decreased, in general, from the Bay of Fundy to 4Vn.

Thorny skate (Raja radiata) was, after cod, the most dominant species in terms of co-occurrences in the fishes examined. Its associations were virtually the same as for cod, but somewhat weaker with shallow-water species (Fig. 3). Co-occurrence indices (Table 1) showed little seasonal variation from the Bay of Fundy to 4W, but higher spring values in 4Vs and 4Vn. They were high in the Bay of Fundy, levelled off along the Shelf from 4X to 4Vs, then fell in 4Vn.

White hake (Urophycis tenuis) was associated with the mid-depth and deep-water groups except in the Bay of Fundy where it co-occurred strongly with shallow-water species also (Fig. 3). In that area (Fig. 3A) there were no strong associations in spring but in summer they appeared with longhorn sculpin and sea raven in the shallow-water group, and with cod, haddock, thorny skate and ocean pout. In autumn these associations were augmented by the addition of winter flounder, spiny dogfish and silver hake. The shallow-water group was poorly represented in other areas. In 4X (Fig. 3B), the cod-haddock-thorny skate assemblage persisted at moderate levels of association, with plaice and silver hake also included at all seasons. They were

joined by pollock in spring, witch flounder in summer and witch flounder and redfish in autumn. In 4W (Fig. 3C), the co-occurrences were weaker and showed considerable seasonal variation, the only notable associations being with plaice, angler, witch flounder and silver hake in spring, and with plaice, witch flounder and redfish in autumn. Co-occurrence indices (Table 1) showed little seasonal variation on the main part of the Shelf but increased from spring to autumn in the Bay of Fundy and from summer to autumn in 4Vn. They showed a general decrease from the Bay of Fundy along the Shelf to 4Vn.

Winter flounder (Pseudopleuronectes americanus) was an important co-occurrant with other species in the Bay of Fundy only (Fig. 3A). There, its strongest associations were with the shallow-water and mid-depth groups, particularly longhorn sculpin and sea raven, and with the cod-thorny skate assemblage. Herring, ocean pout and plaice were added in spring, haddock in summer and spiny dogfish, silver hake and white hake in autumn. In other areas, co-occurrences were weak, with some emphasis on haddock in spring in 4X (Fig. 3B), and in summer and autumn in 4W (Fig. 3C). Yellowtail flounder and longhorn sculpin were also notable co-occurrants in summer and autumn in 4W, together with thorny skate in summer and silver hake in autumn. Except for a weak showing in autumn in 4Vn, winter flounder was absent from both 4Vs (Fig. 3D) and 4Vn (Fig. 3E). Seasonal variation in indices of co-occurrence (Table 1) was erratic, with little obvious pattern except a low level in spring in 4W and a higher autumn level in 4Vn. The indices were high in the Bay of Fundy, fell sharply in 4X and 4W and were negligible in 4Vs and 4Vn.

Winter skate (Raja ocellata) showed no really strong association with any other species and co-occurrences with deep-water species were weak to non-existent in all areas. In the Bay of Fundy (Fig. 3A), it was generally associated with the winter flounder-longhorn sculpin-sea raven and cod-haddock-thorny skate assemblages, with spiny dogfish, silver hake and white hake co-occurring to a greater extent in autumn than in other seasons. In 4X, 4W and 4Vn (Fig. 3B, C, D), associations were weak, apart from that with plaice in 4W in spring. They were stronger in 4Vs where, in spring, longhorn sculpin, cod, haddock, thorny skate, plaice and witch flounder co-occurred at moderate levels. Indices of co-occurrence (Table 1) showed a minor decreasing trend from spring to autumn in all areas except the Bay of Fundy where there was a summer low (Table 1). General levels were higher in the Bay of Fundy, fell to 4X, but then increased along the Shelf to 4Vs before falling to a low level in 4Vn.

Witch flounder (Glyptocephalus cynoglossus) co-occurred mainly with the mid-depth and deep-water species. Its strongest associations, with cod, thorny skate and plaice, persisted through all areas and seasons but were especially strong in 4Vs in spring and summer (Fig. 3D), and in 4Vn (Fig. 3E) in summer. In the Bay of Fundy, cod, haddock, ocean pout, spiny dogfish and white hake were moderately associated in summer and cod, thorny skate, smooth skate, silver hake and white hake in autumn (Fig. 3A). In 4X, haddock, pollock and silver hake co-occurred with witch flounder in spring and haddock and white hake in summer (Fig. 3B), but all associations were weak in autumn. In 4W (Fig. 3C) haddock and silver hake joined the "standard" cod-thorny skate-plaice group at all seasons, white hake and redfish in spring and yellowtail flounder in summer. In 4Vs (Fig. 3D), redfish was moderately associated at all seasons, yellowtail flounder, angler, winter skate, pollock and white hake in spring, and silver hake and white hake in autumn. In 4Vn (Fig. 3E), redfish and white hake co-occurred moderately at all seasons, with pollock in spring, smooth skate and longfin hake in summer, and grenadier and longfin hake in autumn. Indices of co-occurrence (Table 1) showed high spring values but similar summer and autumn values in 4X, 4W and 4Vs, little change in the Bay of Fundy and a high summer level in 4Vn. Geographically, the indices were fairly constant for all areas, with a maximum in 4Vs.

Wolffish (Anarhichas lupus) could not be identified as co-occurring particularly with any other species, although it was associated more strongly with the cod-haddock-thorny skate assemblage, in general, than with others (Fig. 3). It co-occurred with shallow-water species in the Bay of Fundy (Fig. 3A) and to a lessening degree in 4X, 4Vs and 4Vn (Fig. 3B, D, E) but co-occurrences were notably low in 4W (Fig. 3C). It was moderately associated with most of the mid-water group in spring in the Bay of Fundy and 4X but the associations weakened in summer and autumn, both in number and degree. In 4W, co-occurrences were negligible with all species. In 4Vs, there were moderate associations with cod, haddock, thorny skate, plaice and witch in spring, but only cod and plaice persisted notably in summer and they diminished in autumn. In 4Vn, cod was moderately associated in spring, then co-occurrences weakened in summer but recovered in autumn when cod, haddock, thorny skate and white hake strengthened. Indices of co-occurrence (Table 1) showed little seasonal change in any area except for an autumnal decrease in the Bay of Fundy and an increase in 4Vn (Table 1). Geographic changes were erratic with no observable trend.

Yellowtail flounder (Limanda ferruginea) is a member of the shallow-water group (Scott 1982b), but its co-occurrences were stronger with the mid-depth group than with others. In the Bay of Fundy (Fig. 3A), it associated at a moderate degree with longhorn sculpin, sea raven, cod, thorny skate and plaice in spring, but the degree of the associations decreased later. Spiny dogfish, silver hake and white hake co-occurrences increased in summer and autumn. In 4X (Fig. 3B), associations with cod and haddock were moderate in spring but, again, they weakened in summer although they recovered in autumn and were joined by silver hake. In 4W (Fig. 3C), the yellowtail-longhorn sculpin-cod-haddock-thorny skate assemblage persisted throughout the year and was joined by plaice, angler and silver hake in summer and autumn. Similarly, in 4Vs (Fig. 3D), the same basic assemblage appeared in spring, with thorny skate particularly strongly represented, and with winter skate and witch flounder added. In summer, only cod, thorny skate and plaice were moderately associated but in autumn haddock reappeared. In 4Vn (Fig. 3E), there were no notable co-occurrences at any season. Indices of co-occurrence (Table 1) showed minor seasonal changes, with spring maxima in the Bay of Fundy and 4Vs, and autumn maxima in 4X and 4Vn. There were no identifiable geographic trends except for a low level in 4Vn.

The co-occurrence data, being based on randomized trawl sets, should give an accurate

representation of species associations in the area surveyed, within the constraints of the sampling method. Small species such as sand lance may pass through the meshes while flat fish may be over-ridden to produce underestimates of their associations. Pelagic species such as herring and mackerel are available to capture only under certain conditions, which may lead to misinterpretation, both spatial and temporal aspects, of their associations. Several of these species are of comparatively low visibility in the matrices, although better represented than one might have expected, considering their low availability and/or vulnerability to the trawl.

The potential applications of such studies to multispecies fisheries lies in predicting the nature of catches to be expected in trawl fisheries in given areas and seasons. The random nature of the survey design, however, is directly oppposed to the nature of commercial fisheries directed at preferred species and this must be borne in mind in applying the present results to those fisheries. It would be expected that bycatches in a directed fishery would be lower than those indicated by the results of the research survey data.

ACKNOWLEDGMENTS

I am greatly indebted to Drs. R. G. Halliday and J. D. Neilson for helpful comments on the original manuscript which resulted in a much more comprehensive and detailed document than was originally planned. G. Black and J. Gale were responsible for preparation of computer programs and prduction of the numerical matrices, W. McMullon and F. Cunningham for photography, B. Fawkes and J. Hurley for word processing and D. Warren for final editing and processing of the typescript.

REFERENCES

Colvocoresses, J. A., and J. A. Musik. 1984. Species associations and community composition of middle Atlantic Bight Continental Shelf demersal fishes. U.S. Nat. Mar. Fish. Serv. Fish. Bull. 82: 295-313.

Fager, E. W., and A. R. Longhurst. 1968. Recurrent group analysis of special assemblages of demersal fish in the Gulf of Guinea. J. Fish. Res. Board Can. 25: 1405-1421.

Gabriel, W. L., and A. V. Tyler. 1980. Preliminary analysis of Pacific coast demersal fish assembalges. Mar. Fish. Rev. 42 (3-4): 83-88.

Halliday, R. G., and P. A. Koeller. 1981. A history of Canadian groundfish trawling surveys and data usage in ICNAF Division 4TVWX, p. 27-41. In W. G. Doubleday and D. Rivard (ed.) Bottom trawl surveys. Can. Spec. Publ. Fish. Aquat. Sci. 58.

Mahon, R. 1985. Groundfish assemblages on the Scotian Shelf, p. 153-162. In R. Mahon (ed.) Towards the inclusion of fishery interactions in management advice. Can. Tech. Rep. Fish. Aqat. Sci. 1347.

Mahon, R., and E. J. Sandeman. 1985. Fish distributional patterns on the continental shelf and slope from Cape Hatteras to the Hudson Strait - a trawl's eye view, p. 137-152. In R. Mahon (ed.) Towards the inclusion of fishery interactions in management advice. Can. Tech. Rep. Fish. Aquat. Sci. 1347.

Mahon, R., R. W. Smith, B. B. Berstein, and J. S. Scott. 1984. Spatial and temporal patterns of groundfish distribution on the Scotian Shelf and in the Bay of Fundy, 1970-1981. Can. Tech. Rep. Fish. Aquat. Sci. 1300: xi + 164 p.

Scott, J. S. 1982a. Selection of bottom type by groundfishes of the Scotian Shelf. Can. J. Fish. Aquat. Sci. 39: 943-947.

Scott, J. S. 1982b. Depth, temperature and salinity preferences of common fishes of the Scotian Shelf. J. Northwest. Atl. Fish. Sci. 3: 29-39.

Table 1. Dates, cruise numbers and numbers of sets for standard research vessel bottom trawl surveys of the Scotian Shelf and Bay of Fundy, 1970- 84. Vessel designations: A = AT Cameron, H = Lady Hammmond, N = Alfred Needler.

Year	Cruise	Season	No. sets
1970	A175-176	Summer	143
1971	A188-189	Summer	124
1972	A200-201	Summer	162
1973	A212-213	Summer	146
1974	A225-226	Summer	165
1975	A236-237	Summer	145
1976	A250-251	Summer	153
1977	A265-266	Summer	145
1978	H279-280	Summer	148
1979	A292-293	Summer	155
1980	H033-034	Spring	114
1980	A306-307	Summer	150
1980	H042-043	Autumn	145
1981	A321-322	Spring	124
1981	H059-060	Summer	148
1981	H064-065	Autumn	140
1982	H071-072	Spring	136
1982	H080-081	Summer	155
1982	H084-085	Autumn	168
1983	H094-095	Spring	149
1983	N012-013	Summer	149
1983	N017-018	Autumn	185
1984	N024-025	Spring	174
1984	N031-032	Summer	146
1984	N036-037	Autumn	170
		Total	3739

Table 2. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1970-79 Summer 4X Bay of Fundy Number of Tows = 142

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	18	4	49	29	2	20	10	19	23	41	2	19	33	17	28	23	49	62	66	14	2	59	22	55	7	66
YELLOWTAIL..	0	0	0	0	2	8	4	0	4	3	3	2	4	1	4	2	4	3	3	6	8	7	2	0	7	3	7	8	
L.H. SCULPIN	0	0	0	38	4	73	38	5	31	13	35	37	55	1	28	50	15	36	26	67	82	86	18	0	72	23	90		
WINTER SKATE	0	0	0	7	2	24	13	1	7	5	5	10	21	1	8	12	6	10	6	19	28	27	9	2	25	29			
SEA RAVEN...	0	0	0	34	7	75	42	4	28	12	37	38	59	2	28	53	15	37	26	71	87	92	20	2	95				
SAND LAUNCE.	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	0	1	2	2	0	2					
LITTLE SKATE	0	0	0	5	1	21	14	0	7	3	6	9	16	0	4	13	4	12	4	15	21	23	24						
COD.....	0	1	0	53	9	105	57	15	53	19	50	54	76	2	49	66	17	48	33	101	117	130							
HADDOCK.....	0	1	0	45	7	97	50	15	48	17	42	50	76	2	43	60	16	46	32	92	122								
THORNY SKATE	0	1	0	50	8	91	52	15	54	22	51	45	63	2	51	57	12	41	25	109									
WOLFISH.....	0	1	0	18	3	25	10	6	12	5	9	17	20	0	12	16	8	12	33										
HERRING.....	0	0	0	15	1	37	24	3	23	12	21	21	35	1	20	28	8	53											
HALIBUT.....	0	0	0	3	3	11	6	0	4	5	5	7	11	1	6	8	17												
OCEAN POUT..	0	0	0	30	2	58	30	4	30	17	31	29	45	1	30	71													
PLAICE.....	0	1	0	26	5	51	30	8	41	15	31	23	30	0	57														
MACKEREL....	0	0	0	0	0	1	1	0	0	1	1	0	1	2															
SP. DOGFISH.	0	1	0	32	4	67	35	10	28	10	27	33	86																
POLLOCK.....	0	0	0	29	3	48	24	10	28	11	19	56																	
SMOOTH SKATE	0	0	0	26	6	48	26	5	27	12	55																		
ANGLER.....	0	0	0	9	1	21	13	2	15	23																			
WITCH.....	0	1	0	30	4	53	33	11	60																				
CUSK.....	0	1	0	11	0	15	6	16																					
SILVER HAKE.	0	0	0	27	4	61	63																						
WHITE HAKE..	0	1	0	50	8	114																							
EEL POUT....	0	0	0	2	9																								
REDFISH.....	0	1	0	56																									
GRENADIER...	0	0	0																										
ARGENTINE...	0	1																											
LONGFIN HAKE	0																												

Table 3. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1970-79 Summer 4X excluding Bay of Fundy Number of Tows = 245

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	1	0	0	0	1	1	1	1	1	1	0	1	2	3	0	3	3	4	4	0	0	2	2	3	3	4
YELLOWTAIL..	1	8	2	5	0	11	20	12	14	16	14	13	5	3	31	5	36	1	27	43	55	50	7	0	12	23	29	57	
L.H. SCULPIN	2	9	1	17	1	20	26	25	21	18	27	19	4	1	47	12	32	2	44	56	68	65	4	0	23	17	70		
WINTER SKATE	3	8	1	8	0	12	18	12	10	10	13	5	5	1	23	5	16	0	14	25	34	31	2	0	4	36			
SEA RAVEN...	0	2	1	15	0	11	10	12	15	10	13	12	4	1	20	4	18	2	31	31	37	38	1	0	39				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
LITTLE SKATE	0	3	0	2	0	3	6	2	1	3	3	2	0	0	3	1	4	0	1	5	8	5	8						
COD.....	4	27	0	52	1	54	62	62	40	36	50	54	14	6	101	21	71	11	96	124	170	176							
HADDOCK.....	5	46	1	70	1	79	89	84	49	52	58	72	15	12	119	28	74	13	104	148	212								
THORNY SKATE	11	42	8	69	2	80	86	80	55	59	54	57	15	11	112	27	55	12	79	168									
WOLFISH.....	1	12	0	38	1	34	36	35	33	25	33	34	9	6	73	14	44	7	107										
HERRING.....	1	4	0	17	1	17	18	9	13	15	5	12	5	2	15	2	2	20											
HALIBUT.....	0	9	0	10	0	12	19	21	12	17	17	18	6	1	39	6	74												
OCEAN POUT..	5	12	3	21	1	21	23	23	12	12	13	15	1	1	26	32													
PLAICE.....	12	38	8	74	3	83	91	67	60	60	49	53	10	8	145														
MACKEREL....	1	6	0	9	0	10	13	7	7	9	5	7	0	14															
SP. DOGFISH.	0	6	0	10	0	10	9	8	5	7	6	6	19																
POLLOCK.....	3	27	1	46	1	55	46	46	29	28	21	77																	
SMOOTH SKATE	5	18	1	38	1	39	42	32	29	28	67																		
ANGLER.....	7	25	4	50	0	60	61	39	41	77																			
WITCH.....	7	15	6	49	2	51	51	35	68																				
CUSK.....	9	38	4	59	2	65	64	99																					
SILVER HAKE.	14	51	7	79	2	91	120																						
WHITE HAKE..	13	47	9	81	3	108																							
EEL POUT....	1	2	2	3	3																								
REDFISH.....	14	44	9	102																									
GRENADIER...	6	8	9																										
ARGENTINE...	12	66																											
LONGFIN HAKE	15																												

Table 4. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1970-79 Summer 4W

Number of Tows = 445

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	3	0	5	26	0	23	13	17	3	0	7	41	16	6	5	3	38	21	47	2	5	34	22	45	47	48
YELLOWTAIL..	6	10	2	47	4	65	133	10	118	85	89	20	4	21	220	56	62	21	41	205	156	229	6	12	108	55	160	254	
L.H. SCULPIN	11	6	5	41	2	54	108	9	86	70	76	7	1	16	161	49	38	13	25	156	96	160	6	13	94	52	186		
WINTER SKATE	1	0	0	9	0	11	35	1	28	25	24	5	0	9	46	18	14	8	3	44	36	58	4	7	37	60			
SEA RAVEN...	1	0	1	17	0	27	59	1	59	41	43	13	1	15	100	36	26	8	23	95	73	112	4	7	119				
SAND LAUNCE.	3	0	1	2	0	4	7	0	4	7	4	1	0	3	12	5	1	0	1	9	6	13	1	15					
LITTLE SKATE	0	0	0	0	0	1	3	0	3	3	4	0	0	1	4	3	1	0	0	5	2	6	6						
COD.....	5	17	0	72	8	80	147	21	143	94	102	40	3	23	249	59	73	26	56	238	194	300							
HADDOCK.....	6	29	2	68	4	100	136	28	112	72	74	48	5	31	191	58	67	25	52	184	240								
THORNY SKATE	35	42	19	122	10	143	196	42	179	126	125	39	6	24	288	73	71	28	50	338									
WOLFISH.....	1	7	1	29	1	28	32	9	32	25	21	21	3	7	53	21	18	6	67										
HERRING.....	0	3	0	23	0	24	26	2	28	19	15	5	1	4	37	14	10	41											
HALIBUT.....	8	11	5	23	4	42	45	15	43	41	35	18	0	9	71	24	89												
OCEAN POUT..	10	6	4	35	1	47	65	7	52	42	41	9	3	10	75	89													
PLAICE.....	34	50	18	150	11	157	222	35	194	138	129	40	7	33	368														
MACKEREL....	1	10	1	13	0	22	30	8	22	15	7	11	1	41															
SP. DOGFISH.	0	3	0	5	0	5	6	1	5	2	3	1	7																
POLLOCK.....	2	13	0	23	1	26	26	19	22	20	15	58																	
SMOOTH SKATE	15	16	5	59	4	71	102	17	87	61	143																		
ANGLER.....	23	28	13	73	5	89	110	21	102	160																			
WITCH.....	18	33	8	96	9	108	138	16	217																				
CUSK.....	12	19	11	29	0	32	32	54																					
SILVER HAKE.	32	48	13	116	7	147	258																						
WHITE HAKE..	32	52	16	113	8	188																							
EEL POUT....	4	2	0	9	11																								
REDFISH.....	35	45	21	169																									
GRENADIER...	21	10	23																										
ARGENTINE...	17	63																											
LONGFIN HAKE	42																												

lable 5. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1970-79 Summer 4Vs Number of Tows = 291

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	1	0	1	1	1
YELLOWTAIL..	6	3	6	27	2	26	29	2	74	12	40	8	1	8	120	4	16	0	26	122	32	116	0	16	19	24	61	127	
L.H. SCULPIN	2	2	3	17	1	14	14	0	43	10	23	3	0	5	65	2	8	0	14	66	20	65	0	9	16	20	70		
WINTER SKATE	5	0	5	7	0	10	12	1	19	6	12	5	0	3	25	1	7	0	3	27	14	27	0	2	8	29			
SEA RAVEN...	0	1	0	3	0	4	4	0	15	1	7	1	0	3	20	0	3	0	4	19	9	20	0	0	20				
SAND LAUNCE.	0	0	1	4	1	1	3	0	7	2	3	0	0	0	20	1	0	0	5	20	2	19	0	20					
LITTLE SKATE	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1						
COD.....	30	11	25	107	18	61	41	6	137	30	71	15	2	9	211	12	27	2	64	205	46	231							
HADDOCK.....	4	4	3	18	3	14	14	2	28	13	15	7	0	6	45	2	15	2	16	45	49								
THORNY SKATE	44	17	34	119	19	71	46	7	165	36	93	17	1	9	234	13	31	2	60	259									
WOLFISH.....	8	7	5	41	5	19	3	3	41	11	22	5	1	3	60	3	11	1	71										
HERRING.....	0	0	0	0	1	0	0	0	2	0	0	0	0	1	2	0	1	2											
HALIBUT.....	11	9	9	24	0	23	13	4	28	17	18	6	1	2	33	3	38												
OCEAN POUT..	4	5	4	9	0	6	2	3	10	6	6	0	0	0	12	15													
PLAICE.....	33	14	27	113	21	69	52	5	161	36	89	15	2	8	260														
MACKEREL....	0	0	0	2	0	1	4	0	7	3	1	1	0	9															
SP. DOGFISH.	0	0	0	1	0	1	1	0	1	0	1	0	2																
POLLOCK.....	7	2	4	13	1	11	4	4	8	3	2	19																	
SMOOTH SKATE	24	7	23	53	6	45	29	0	67	24	102																		
ANGLER.....	18	5	14	29	1	27	14	1	35	44																			
WITCH.....	37	11	27	95	17	59	38	1	179																				
CUSK.....	6	6	6	8	0	6	1	8																					
SILVER HAKE.	13	4	9	22	1	27	54																						
WHITE HAKE..	39	14	32	63	6	87																							
EEL POUT....	3	0	0	18	22																								
REDFISH.....	47	16	37	138																									
GRENADIER...	34	13	39																										
ARGENTINE...	13	20																											
LONGFIN HAKE	50																												

Table 6. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1970-79 Summer 4Vn Number of Tows = 73

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOWTAIL..	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	1	2	0	0	0	0	0	0	0	2	
L.H. SCULPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1		
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
SEA RAVEN...	1	0	1	2	0	2	1	0	1	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	5				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
COD.....	6	0	7	22	6	20	8	0	30	7	19	3	0	0	45	0	1	0	1	42	11	54							
HADDOCK.....	0	0	0	4	1	5	1	0	7	1	5	1	0	0	8	2	0	1	3	8	11								
THORNY SKATE	13	0	15	29	6	23	7	0	37	11	29	3	0	0	47	2	1	1	9	57									
WOLFISH.....	3	0	4	14	2	12	5	0	19	4	14	3	0	0	20	2	1	1	7										
HERRING.....	0	0	0	1	0	2	1	0	4	0	2	0	0	0	9	0	0	1	10										
HALIBUT.....	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1												
OCEAN POUT..	0	0	0	1	0	1	0	0	1	1	1	0	0	0	1	2													
PLAICE.....	11	0	12	26	8	22	9	0	35	10	25	3	0	0	56														
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0															
SP. DOGFISH.	1	0	0	1	0	1	0	0	1	1	1	0	0																
POLLOCK.....	0	0	0	2	2	1	0	0	3	0	3	3																	
SMOOTH SKATE	14	0	15	28	7	22	4	0	30	11	33																		
ANGLER.....	11	0	10	16	4	14	5	0	14	17																			
WITCH.....	17	0	17	31	7	26	7	0	45																				
CUSK.....	0	0	0	0	0	0	0	0																					
SILVER HAKE.	3	0	2	7	2	7	10																						
WHITE HAKE..	12	0	13	26	6	30																							
EEL POUT....	2	0	3	7	8																								
REDFISH.....	18	0	19	38																									
GRENADIER...	15	0	19																										
ARGENTINE...	0	0																											
LONGFIN HAKE	18																												

Table 7. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Spring 4X Bay of Fundy Number of Tows = 58

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	11	0	12	14	3	17	2	22	21	2	0	32	37	14	30	13	38	18	47	20	0	48	26	48	19	51
YELLOWTAIL..	0	0	0	2	0	2	1	0	4	0	9	11	0	0	15	14	7	11	6	15	9	17	7	0	19	13	19	19	
L.H. SCULPIN	0	0	0	13	0	11	13	4	17	1	24	23	2	0	34	36	16	28	14	39	20	49	19	0	48	25	53		
WINTER SKATE	0	0	0	3	0	3	2	2	6	0	12	8	0	0	13	20	8	11	6	17	6	25	14	0	26	26			
SEA RAVEN...	0	0	0	12	0	10	12	2	14	1	21	22	1	0	32	37	14	29	13	37	19	48	19	0	51				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
LITTLE SKATE	0	0	0	1	0	4	3	2	4	0	8	5	0	0	9	14	4	12	3	12	3	18	20						
COD.....	0	0	0	14	0	12	16	5	17	2	22	23	1	0	33	38	16	29	14	40	22	54							
HADDOCK.....	0	0	0	5	0	7	8	4	8	2	8	13	0	0	16	16	9	13	8	20	22								
THORNY SKATE	0	0	0	13	0	12	15	5	17	2	21	20	2	0	32	30	12	23	12	43									
WOLFISH.....	0	0	0	6	0	1	3	2	5	0	7	9	1	0	13	12	4	5	14										
HERRING.....	0	0	0	6	0	9	11	2	13	2	11	10	2	0	21	20	9	33											
HALIBUT.....	0	0	0	3	0	5	5	2	6	1	5	6	1	0	12	11	16												
OCEAN POUT..	0	0	0	9	0	9	10	3	11	2	16	17	1	0	23	39													
PLAICE.....	0	0	0	11	0	11	14	3	18	1	18	19	2	0	37														
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0															
SP. DOGFISH.	0	0	0	1	0	0	1	0	1	0	1	0	2																
POLLOCK.....	0	0	0	8	0	4	7	1	6	0	9	24																	
SMOOTH SKATE	0	0	0	7	0	6	8	1	11	0	24																		
ANGLER.....	0	0	0	0	0	2	2	1	2	2																			
WITCH.....	0	0	0	5	0	10	14	4	20																				
CUSK.....	0	0	0	1	0	3	3	5																					
SILVER HAKE.	0	0	0	6	0	9	17																						
WHITE HAKE..	0	0	0	6	0	13																							
EEL POUT....	0	0	0	0	0																								
REDFISH.....	0	0	0	14																									
GRENADIER...	0	0	0																										
ARGENTINE...	0	0																											
LONGFIN HAKE	0																												

Table 8. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Spring 4X excluding Bay of Fundy Number of Tows = 143

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	5	0	3	5	3	7	4	3	8	2	0	16	2	6	5	9	11	17	17	3	2	10	8	10	13	17
YELLOWTAIL..	0	3	0	10	0	6	9	9	11	10	10	25	10	2	32	4	21	15	26	25	40	40	7	2	13	16	22	40	
L.H. SCULPIN	0	6	0	23	0	10	19	20	17	10	13	32	11	2	42	11	22	23	33	34	51	51	8	1	21	13	51		
WINTER SKATE	1	4	0	4	0	3	6	7	6	5	5	17	8	1	19	6	12	9	14	12	24	23	5	2	9	13			
SEA RAVEN...	0	4	0	12	0	6	7	10	11	5	8	16	4	0	20	8	11	12	18	20	26	26	4	1	2	26			
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	1	0	1	1	2	2	0	2					
LITTLE SKATE	1	3	0	0	0	2	3	4	4	2	4	9	4	0	8	4	5	5	4	8	10	10	10						
COD.....	8	24	2	45	0	36	49	39	43	30	27	74	37	6	84	20	47	43	58	69	117	120							
HADDOCK.....	8	30	0	54	0	43	61	47	52	38	30	84	45	8	96	22	51	48	59	75	132								
THORNY SKATE	9	25	0	39	0	35	43	30	38	29	30	59	28	7	67	18	28	35	34	80									
WOLFISH.....	1	9	0	27	0	12	15	18	18	12	16	34	10	1	43	11	32	18	59										
HERRING.....	2	14	0	23	0	20	33	16	26	22	13	36	19	6	39	10	20	51											
HALIBUT.....	1	10	0	17	0	10	17	21	17	14	12	37	15	2	36	12	51												
OCEAN POUT..	1	7	0	13	0	9	11	13	11	5	7	18	6	0	18	22													
PLAICE.....	7	26	0	48	0	44	54	41	49	37	27	64	34	6	101														
MACKEREL....	2	7	0	6	0	4	8	3	5	4	4	7	7	10															
SP. DOGFISH.	9	30	1	16	0	30	40	25	26	20	14	44	52																
POLLOCK.....	11	34	2	40	0	42	52	41	39	31	26	91																	
SMOOTH SKATE	5	13	0	15	0	18	19	14	18	14	32																		
ANGLER.....	5	16	1	22	0	28	34	18	31	43																			
WITCH.....	5	18	0	32	0	33	43	24	56																				
CUSK.....	5	18	1	27	0	29	35	50																					
SILVER HAKE.	11	31	2	36	0	46	69																						
WHITE HAKE..	10	27	2	27	0	52																							
EEL POUT....	0	0	0	0	0																								
REDFISH.....	6	16	0	57																									
GRENADIER...	1	2	2																										
ARGENTINE...	10	37																											
LONGFIN HAKE	11																												

Table 9. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Spring 4W Number of Tows = 239

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	1	0	0	1	0	3	1	3	2	0	0	18	1	0	2	3	17	4	16	4	1	9	15	18	19	20
YELLOWTAIL..	1	8	1	18	0	10	26	4	35	31	36	26	9	9	108	9	28	22	12	89	72	100	11	7	43	59	90	122	
L.H. SCULPIN	4	10	1	20	0	16	30	5	33	29	34	32	14	6	98	10	28	21	10	89	66	87	10	8	42	54	113		
WINTER SKATE	2	5	1	11	0	9	14	0	22	14	23	10	5	3	64	6	19	9	4	54	33	56	5	2	28	68			
SEA RAVEN...	0	2	0	8	0	3	9	2	9	12	11	13	2	0	43	5	8	9	6	41	26	43	6	3	51				
SAND LAUNCE.	0	0	0	1	0	0	0	0	1	0	3	3	0	0	4	0	1	1	1	8	4	5	0	10					
LITTLE SKATE	0	2	0	3	0	2	3	0	3	3	3	2	2	0	12	2	1	3	1	10	5	9	12						
COD.....	1	30	0	41	1	28	60	17	60	51	43	62	40	18	129	15	51	41	18	106	121	160							
HADDOCK.....	3	45	1	45	1	48	84	24	72	67	38	71	53	23	116	14	54	37	17	89	154								
THORNY SKATE	16	27	8	43	0	40	58	13	59	51	50	44	28	10	121	15	45	27	15	146									
WOLFISH.....	1	2	0	4	0	3	7	2	9	4	8	10	5	3	19	2	7	9	22										
HERRING.....	1	12	0	13	0	9	23	8	21	20	10	20	14	10	36	5	17	44											
HALIBUT.....	15	30	9	28	1	33	49	15	41	39	25	30	24	12	53	5	72												
OCEAN POUT..	3	8	1	10	0	11	14	4	10	12	7	8	5	2	17	21													
PLAICE.....	16	38	9	55	0	54	82	15	90	75	57	54	35	16	181														
MACKEREL....	1	14	1	9	1	9	21	9	11	13	4	9	11	24															
SP. DOGFISH.	4	39	0	22	1	29	49	21	30	29	12	36	61																
POLLOCK.....	2	33	3	36	1	35	56	20	40	33	16	82																	
SMOOTH SKATE	11	12	6	25	0	19	28	4	37	30	61																		
ANGLER.....	19	39	10	39	1	50	69	14	61	89																			
WITCH.....	17	35	9	52	1	54	72	17	102																				
CUSK.....	8	24	5	17	1	16	30	31																					
SILVER HAKE.	22	58	11	60	1	69	113																						
WHITE HAKE..	20	40	10	43	0	71																							
EEL POUT....	0	1	0	1	1																								
REDFISH.....	17	35	10	74																									
GRENADIER...	10	7	11																										
ARGENTINE...	14	60																											
LONGFIN HAKE	22																												

Table 10. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Spring 4Vs

Number of Tows = 130

	LONGFIN HAKE	ARGENTINE	GREENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	1
YELLOWTAIL..	2	2	2	16	0	14	8	1	24	9	27	12	3	0	63	1	17	3	28	63	29	51	2	10	10	38	65		
L.H. SCULPIN	3	3	2	12	0	9	5	2	15	5	15	8	3	0	44	1	6	2	24	45	18	41	2	8	8	25	46		
WINTER SKATE	5	4	6	20	0	20	8	3	28	12	24	15	6	0	54	2	20	2	29	54	34	47	0	5	13	57			
SEA RAVEN...	0	0	0	1	0	4	0	0	5	1	6	4	0	0	15	1	1	0	7	15	7	12	0	0	15				
SAND LAUNCE.	1	0	1	1	0	1	0	0	1	0	4	3	0	0	12	0	2	0	6	12	4	7	0	12					
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	1	2	0						
COD.....	12	10	9	47	0	33	20	3	55	19	40	34	9	0	98	6	22	7	44	96	48	104							
HADDOCK.....	5	4	4	22	0	20	10	3	33	14	31	25	5	0	52	2	22	5	32	55	56								
THORNY SKATE	14	8	12	46	0	35	21	4	62	22	49	36	9	0	115	6	28	8	47	122									
WOLFISH.....	3	4	3	20	0	16	6	3	26	7	24	17	3	0	46	1	14	2	49										
HERRING.....	0	1	0	6	0	2	2	1	5	1	3	6	1	0	9	2	3	9											
HALIBUT.....	5	2	5	12	0	14	8	2	21	11	19	13	3	0	27	0	29												
OCEAN POUT..	1	1	0	4	0	1	2	0	4	0	1	4	0	0	6	7													
PLAICE.....	15	10	14	47	0	36	24	3	59	23	47	37	12	0	122														
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0															
SP. DOGFISH.	6	4	6	9	0	9	7	1	10	5	5	5	12																
POLLOCK.....	9	7	8	24	0	21	11	3	28	11	19	41																	
SMOOTH SKATE	6	4	4	24	0	19	11	3	35	11	50																		
ANGLER.....	8	5	10	17	0	19	14	1	24	25																			
WITCH.....	14	10	12	42	0	35	22	3	65																				
CUSK.....	1	1	1	4	0	4	2	4																					
SILVER HAKE.	13	8	10	19	0	22	26																						
WHITE HAKE..	15	11	14	29	0	41																							
EEL POUT....	0	0	0	0	0																								
REDFISH.....	15	10	13	52																									
GRENADIER...	12	5	14																										
ARGENTINE...	6	11																											
LONGFIN HAKE	16																												

Table 11. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Spring 4Vn Number of Tows = 9

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOWTAIL..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
L.H. SCULPIN	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1		
WINTER SKATE	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0			
SEA RAVEN...	0	0	0	3	0	2	0	0	2	0	3	2	0	0	2	0	0	0	1	0	0	3	0	0	3				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
COD.....	0	0	0	4	0	3	1	0	3	1	2	5	0	0	7	1	0	3	0	4	2	8							
HADDOCK.....	0	0	0	2	0	2	1	0	2	1	1	2	0	0	2	0	0	1	0	2	2								
THORNY SKATE	0	0	0	4	0	3	1	0	3	1	3	3	0	0	4	1	0	2	0	5									
WOLFISH.....	0	0	0	2	0	1	0	0	0	0	1	2	0	0	2	1	0	3	3										
HERRING.....	0	0	0	1	0	1	0	0	1	0	0	2	0	0	3	1	0	3											
HALIBUT.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												
OCEAN POUT..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1													
PLAICE.....	0	0	0	4	0	4	1	0	4	1	2	4	0	0	8														
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0															
SP. DOGFISH.	0	0	0	0	0	0	0	0	0	0	0	0	0																
POLLOCK.....	0	0	0	4	0	3	1	0	3	1	2	5																	
SMOOTH SKATE	0	0	0	3	0	2	0	0	2	0	3																		
ANGLER.....	0	0	0	1	0	1	1	0	1	1																			
WITCH.....	0	0	0	3	0	3	1	0	4																				
CUSK.....	0	0	0	0	0	0	0	0																					
SILVER HAKE.	0	0	0	1	0	1	1																						
WHITE HAKE..	0	0	0	4	0	4																							
EEL POUT....	0	0	0	0	0																								
REDFISH.....	0	0	0	5																									
GRENADIER...	0	0	0																										
ARGENTINE...	0	0																											
LONGFIN HAKE	0																												

Table 12. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Summer 4X Bay of Fundy Number of Tows = 78

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	HADDOCK	THORNY SKATE	WOLFISH	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	YELLOWTAIL	L.H. SCULPIN	WINTER FL
WINTER FL...	0	1	0	6	1	37	23	0	11	9	8	23	32	2	20	32	6	29	18	33	44	46	13	2	46	17	41	11	51
YELLOWTAIL..	0	1	0	0	0	10	7	0	5	4	1	3	8	2	10	7	3	6	6	8	11	11	1	0	10	2	9	11	
L.H. SCULPIN	0	1	0	12	1	44	25	1	17	9	12	25	30	2	22	35	4	27	20	38	48	48	14	1	48	14	53		
WINTER SKATE	0	0	0	0	1	12	8	0	1	1	1	7	11	0	3	7	3	13	2	8	16	16	7	2	15	18			
SEA RAVEN...	0	1	0	13	1	46	24	0	17	11	15	27	35	2	25	37	4	30	20	42	50	55	12	2	58				
SAND LAUNCE.	0	0	0	0	1	1	2	0	0	0	1	2	2	0	1	0	1	1	0	1	1	2	1	2					
LITTLE SKATE	0	0	0	0	1	12	10	0	6	0	3	7	13	0	4	9	1	12	3	9	12	12	16						
COD.....	0	1	0	18	1	57	33	3	28	12	17	34	43	2	39	46	6	33	21	54	62	71							
HADDOCK.....	0	1	0	17	1	52	28	3	24	13	15	30	39	2	34	43	5	33	21	48	65								
THORNY SKATE	0	1	0	15	0	47	27	3	27	11	19	29	36	1	37	43	2	23	18	57									
WOLFISH.....	0	1	0	7	0	19	10	1	7	3	6	10	11	0	11	17	2	9	21										
HERRING.....	0	1	0	6	1	26	22	1	11	6	3	13	24	2	13	20	1	36											
HALIBUT.....	0	0	0	0	0	3	3	0	2	0	1	2	3	0	4	4	6												
OCEAN POUT..	0	1	0	11	0	41	23	1	25	8	15	21	27	1	31	50													
PLAICE.....	0	1	0	11	0	34	24	3	26	10	16	20	26	2	41														
MACKEREL....	0	0	0	0	0	2	2	0	1	2	0	0	2	2															
SP. DOGFISH.	0	0	0	10	1	38	22	3	21	10	11	19	49																
POLLOCK.....	0	0	0	10	1	30	19	3	15	6	11	36																	
SMOOTH SKATE	0	0	0	6	0	15	9	1	10	6	20																		
ANGLER.....	0	0	0	3	0	10	4	0	5	14																			
WITCH.....	0	1	0	8	0	27	20	2	32																				
CUSK.....	0	0	0	3	0	3	2	3																					
SILVER HAKE.	0	1	0	8	1	31	36																						
WHITE HAKE..	0	1	0	16	1	60																							
EEL POUT....	0	0	0	0	1																								
REDFISH.....	0	0	0	18																									
GRENADIER...	0	0	0																										
ARGENTINE...	0	1																											
LONGFIN HAKE	0																												

Table 13. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Summer 4X excluding Bay of Fundy Number of Tows = 137

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	0	0	1	4	0	2	3	1	1	5	0	5	4	4	2	6	5	9	9	2	1	4	4	6	7	9
YELLOWTAIL..	0	4	0	3	0	1	8	5	6	6	3	7	16	0	15	5	14	1	16	19	31	27	5	3	10	6	16	31	
L.H. SCULPIN	1	5	1	16	0	11	16	12	11	8	13	9	18	0	25	12	13	4	25	32	39	35	2	2	16	5	39		
WINTER SKATE	0	2	0	1	0	0	3	2	1	2	0	1	4	0	2	2	3	1	4	6	8	7	2	1	2	8			
SEA RAVEN...	0	2	0	9	0	6	5	7	4	3	9	6	12	0	14	11	9	2	19	19	23	21	1	0	23				
SAND LAUNCE.	0	0	0	0	0	0	0	1	0	1	0	0	3	0	2	0	0	1	1	1	4	4	1	4					
LITTLE SKATE	1	2	0	1	0	1	3	2	1	2	0	0	2	0	3	1	2	0	1	4	5	4	6						
COD.....	3	18	1	36	0	25	28	24	26	16	16	31	35	1	53	13	31	7	44	65	96	98							
HADDOCK.....	8	31	2	52	0	42	46	35	37	26	22	41	44	1	72	20	36	12	50	80	124								
THORNY SKATE	11	21	2	41	1	34	34	27	27	19	22	29	30	1	56	16	28	7	38	86									
WOLFISH.....	1	7	0	19	0	17	13	12	16	7	12	15	18	1	37	13	20	5	50										
HERRING.....	0	3	0	8	0	9	11	6	8	6	4	5	5	0	9	6	1	13											
HALIBUT.....	5	7	1	11	0	9	10	8	11	5	5	8	11	1	22	8	38												
OCEAN POUT..	2	5	0	16	1	12	14	8	11	13	12	8	10	0	18	23													
PLAICE.....	12	20	4	47	1	43	39	26	39	27	21	31	26	1	82														
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	1															
SP. DOGFISH.	1	14	0	18	0	16	16	13	17	13	8	21	46																
POLLOCK.....	1	14	0	25	0	24	25	19	20	14	7	43																	
SMOOTH SKATE	4	5	1	21	1	18	14	13	19	11	27																		
ANGLER.....	6	14	1	24	1	24	27	13	20	34																			
WITCH.....	6	12	2	32	0	34	26	21	44																				
CUSK.....	8	18	2	29	0	26	23	40																					
SILVER HAKE.	9	26	2	35	1	38	57																						
WHITE HAKE..	11	24	3	40	0	52																							
EEL POUT....	1	0	0	1	1																								
REDFISH.....	13	22	3	63																									
GRENADIER...	4	1	4																										
ARGENTINE...	8	36																											
LONGFIN HAKE	14																												

Table 14. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Summer 4W Number of Tows = 260

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	1	0	0	0	0	3	24	0	13	19	9	4	0	7	30	8	5	5	5	27	32	34	3	1	19	19	28	35	35
YELLOWTAIL..	4	12	2	13	0	33	70	2	52	67	37	15	4	16	122	17	30	16	17	102	123	115	6	9	36	33	80	137	
L.H. SCULPIN	2	11	0	9	0	24	54	5	39	43	31	14	2	10	88	17	22	12	15	73	84	85	5	6	32	29	95		
WINTER SKATE	3	3	2	6	1	5	24	1	17	13	11	4	1	5	34	10	5	9	5	32	32	35	2	2	15	39			
SEA RAVEN...	0	2	0	5	0	8	25	2	19	20	12	5	1	7	35	8	6	6	7	30	38	37	4	2	40				
SAND LAUNCE.	0	2	0	3	0	4	2	0	3	4	5	2	0	2	9	1	2	0	1	9	10	8	1	10					
LITTLE SKATE	0	0	0	0	0	1	6	0	1	3	1	0	1	1	6	1	0	2	0	3	7	6	7						
COD.....	7	19	0	31	1	42	84	14	66	64	41	36	8	18	142	24	36	19	23	105	155	170							
HADDOCK.....	8	42	1	49	1	73	123	20	84	89	44	52	20	25	171	30	43	25	29	118	209								
THORNY SKATE	12	25	6	36	1	48	78	9	66	67	46	24	11	11	124	26	25	16	17	144									
WOLFISH.....	0	7	0	9	0	10	15	4	14	12	8	6	4	3	23	8	11	2	30										
HERRING.....	1	3	0	10	0	14	20	2	15	14	9	10	8	3	26	11	3	26											
HALIBUT.....	4	14	1	12	0	20	25	7	23	25	13	16	2	7	38	8	49												
OCEAN POUT..	4	10	2	19	1	19	27	5	22	21	16	8	3	4	36	39													
PLAICE.....	21	45	9	68	2	90	125	18	93	102	49	42	21	22	209														
MACKEREL....	2	4	1	7	0	11	21	2	11	11	2	10	5	26															
SP. DOGFISH.	4	14	1	17	0	23	23	4	11	15	1	12	26																
POLLOCK.....	3	22	0	28	0	32	36	11	24	25	7	55																	
SMOOTH SKATE	6	16	2	18	1	21	35	5	26	25	57																		
ANGLER.....	14	32	8	44	1	68	79	13	54	115																			
WITCH.....	14	26	6	44	2	61	76	10	105																				
CUSK.....	7	15	3	19	0	19	18	27																					
SILVER HAKE.	16	48	6	54	1	76	150																						
WHITE HAKE..	22	47	9	59	1	107																							
EEL POUT....	0	1	0	2	2																								
REDFISH.....	23	39	10	80																									
GRENADIER...	10	6	11																										
ARGENTINE...	17	63																											
LONGFIN HAKE	26																												

Table 15. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Summer 4Vs

Number of Tows = 164

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOWTAIL..	1	2	1	6	0	5	23	0	33	3	21	3	1	2	59	1	11	1	7	58	37	50	1	6	11	20	26	61	
L.H. SCULPIN	1	1	0	6	0	2	12	0	16	0	9	1	0	2	28	1	3	0	4	29	15	25	1	4	9	16	30		
WINTER SKATE	7	4	4	17	0	12	13	3	24	5	13	7	2	0	32	2	8	0	10	32	20	35	0	3	9	38			
SEA RAVEN...	1	0	1	2	0	2	6	0	10	0	5	2	0	0	11	0	2	0	2	12	10	11	0	1	13				
SAND LAUNCE.	2	0	1	2	0	2	4	0	6	1	3	0	0	1	8	0	0	1	2	6	2	7	0	8					
LITTLE SKATE	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1						
COD.....	19	13	13	66	1	39	38	6	90	17	45	17	8	2	129	17	21	7	50	117	65	141							
HADDOCK.....	3	9	2	28	0	14	27	5	39	7	22	13	7	1	66	5	22	1	25	63	75								
THORNY SKATE	11	11	9	50	1	28	34	3	82	13	47	9	7	3	126	16	21	5	39	137									
WOLFISH.....	10	8	7	35	1	16	14	5	32	9	15	10	5	0	46	9	11	2	52										
HERRING.....	2	0	2	5	0	4	1	0	5	2	1	1	1	0	7	2	0	7											
HALIBUT.....	5	7	3	14	0	13	14	2	14	6	14	7	5	0	27	0	29												
OCEAN POUT..	0	0	0	11	0	1	1	0	14	0	6	0	1	1	17	17													
PLAICE.....	18	11	13	65	1	37	39	1	97	20	47	13	9	3	150														
MACKEREL....	0	0	0	1	0	0	1	0	2	0	0	0	0	3															
SP. DOGFISH.	3	5	2	9	0	7	3	2	6	2	3	2	11																
POLLOCK.....	7	6	5	13	0	11	9	5	7	6	3	18																	
SMOOTH SKATE	8	5	6	22	0	17	18	1	30	6	51																		
ANGLER.....	9	7	6	17	0	18	12	1	15	22																			
WITCH.....	16	7	12	48	1	31	27	0	98																				
CUSK.....	3	4	3	6	0	5	2	6																					
SILVER HAKE.	7	8	6	21	0	17	42																						
WHITE HAKE..	19	10	14	37	0	45																							
EEL POUT....	0	0	0	0	1																								
REDFISH.....	21	13	15	73																									
GRENADIER...	12	4	15																										
ARGENTINE...	8	17																											
LONGFIN HAKE	22																												

Table 16. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Summer 4Vn

Number of Tows = 45

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YELLOWTAIL..	0	0	0	0	0	0	0	0	2	0	1	0	0	0	2	0	0	0	0	0	2	0	0	0	1	0	0	2	0
L.H. SCULPIN	0	0	0	0	0	2	0	0	3	0	2	0	0	0	5	0	0	2	0	0	5	0	0	0	2	0	5		
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	0	2	0	0		
SEA RAVEN...	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0	2	0	0	0	1	0	2		
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
COD.....	5	1	5	18	1	16	3	0	26	5	17	4	4	0	33	4	0	7	8	30	17	39							
HADDOCK.....	0	0	0	10	0	6	1	0	13	2	8	4	2	1	14	2	0	4	5	14	17								
THORNY SKATE	8	1	7	16	1	11	2	0	25	6	17	2	1	0	27	3	0	6	7	35									
WOLFISH.....	1	0	0	6	1	4	0	0	6	0	3	3	2	0	7	0	0	1	9										
HERRING.....	3	0	3	5	0	5	2	0	7	1	3	1	1	0	6	3	0	8											
HALIBUT.....	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0												
OCEAN POUT..	1	0	1	2	0	1	1	0	3	0	3	0	1	0	4	4													
PLAICE.....	5	1	4	13	1	12	2	0	23	3	15	2	2	0	34														
MACKEREL....	1	0	1	1	0	0	0	0	1	0	1	0	1	1															
SP. DOGFISH.	2	0	1	4	0	3	0	0	3	0	1	1	2	4															
POLLOCK.....	0	0	0	4	0	2	0	0	2	1	1	4	4																
SMOOTH SKATE	4	1	5	10	1	7	2	0	15	4	19																		
ANGLER.....	4	1	4	7	0	5	1	0	6	7																			
WITCH.....	11	1	10	22	0	17	3	0	32																				
CUSK.....	0	0	0	0	0	0	0	0																					
SILVER HAKE.	2	0	2	3	0	3	3																						
WHITE HAKE..	7	1	6	15	0	18																							
EEL POUT....	0	0	0	0	1																								
REDFISH.....	11	1	10	24																									
GRENADIER...	9	1	10																										
ARGENTINE...	1	1																											
LONGFIN HAKE	11																												

Table 17. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Autumn 4X Bay of Fundy

Number of Tows = 78

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	1	0	0	10	2	52	55	5	12	14	14	14	41	7	18	32	7	24	3	39	35	51	19	0	47	28	44	16	56
YELLOWTAIL..	1	0	0	2	0	14	16	2	3	3	2	3	11	3	7	8	5	6	1	9	15	16	8	0	15	9	15	17	
L.H. SCULPIN	1	0	0	11	2	50	52	6	6	12	12	11	43	9	15	32	6	23	3	39	33	50	19	0	43	26	53		
WINTER SKATE	1	0	0	2	1	26	28	2	1	5	4	3	24	2	6	17	4	16	1	19	20	27	12	0	26	30			
SEA RAVEN...	1	0	0	12	2	49	51	3	9	13	14	12	40	8	19	31	6	19	3	35	32	48	18	0	53				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
LITTLE SKATE	1	0	0	2	0	19	20	1	1	2	2	5	14	5	5	10	3	10	0	13	15	20	20						
COD.....	1	0	0	19	2	67	70	12	23	15	27	18	50	10	27	39	7	29	3	56	47	71							
HADDOCK.....	1	0	0	10	1	46	48	11	16	12	19	12	33	7	19	26	7	16	3	37	49								
THORNY SKATE	1	0	0	19	3	58	58	12	23	15	27	18	39	7	24	35	5	26	3	58									
WOLFISH.....	0	0	0	2	1	3	3	2	1	2	1	1	2	0	2	3	0	2											
HERRING.....	1	0	0	7	3	31	31	5	11	7	12	4	25	2	14	17	1	31											
HALIBUT.....	0	0	0	1	0	7	7	1	2	1	1	3	5	2	2	3	7												
OCEAN POUT..	0	0	0	12	3	41	41	6	12	13	19	12	26	6	19	41													
PLAICE.....	0	0	0	10	2	31	30	3	19	11	18	6	19	4	31														
MACKEREL....	0	0	0	1	0	10	10	1	3	2	2	4	7	10															
SP. DOGFISH.	0	0	0	11	3	51	53	6	14	14	16	10	55																
POLLOCK.....	0	0	0	8	0	18	18	5	9	4	10	18																	
SMOOTH SKATE	0	0	0	14	2	29	29	8	20	7	29																		
ANGLER.....	0	0	0	6	2	17	17	2	8	17																			
WITCH.....	0	0	0	10	2	25	25	7	25																				
CUSK.....	0	0	0	6	0	12	12	12																					
SILVER HAKE.	1	0	0	19	3	72	75																						
WHITE HAKE..	1	0	0	19	3	73																							
EEL POUT....	0	0	0	1	3																								
REDFISH.....	0	0	0	19																									
GRENADIER...	0	0	0																										
ARGENTINE...	0	0																											
LONGFIN HAKE	1																												

Table 18. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Autumn 4X excluding Bay of Fundy

Number of Tows = 172

	LONGFIN HAKE	ARGENTINE	GREENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	1	0	3	8	1	0	2	1	6	10	0	4	3	5	4	7	11	15	15	6	0	6	7	9	14	15
YELLOWTAIL..	0	6	0	16	0	18	44	8	13	22	7	24	27	2	38	9	25	10	20	41	64	57	25	0	15	20	41	64	
L.H. SCULPIN	2	8	1	35	0	23	43	15	13	18	15	34	18	5	39	12	30	12	35	47	70	65	22	0	28	13	71		
WINTER SKATE	1	6	0	3	0	9	13	5	5	8	4	9	10	0	12	2	8	5	7	15	23	20	9	0	5	23			
SEA RAVEN...	0	4	0	18	0	5	16	10	4	5	3	22	7	0	14	8	16	8	23	22	31	30	6	0	31				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
LITTLE SKATE	2	6	0	5	0	9	20	5	4	8	4	9	8	1	13	6	13	7	10	18	30	26	31						
COD.....	5	14	1	56	0	37	64	26	26	29	16	55	33	6	67	17	38	16	48	79	124	125							
HADDOCK.....	10	32	3	76	0	64	96	33	40	45	21	67	40	6	89	20	45	17	48	101	160								
THORNY SKATE	14	26	6	57	1	55	75	27	35	38	23	47	28	3	67	18	29	13	34	110									
WOLFISH.....	1	3	1	29	0	14	26	15	14	13	7	32	9	2	27	9	21	9	49										
HERRING.....	0	1	0	8	0	9	14	0	7	8	2	10	6	2	11	5	5	17											
HALIBUT.....	1	9	1	16	0	11	23	10	7	8	5	19	12	2	25	4	46												
OCEAN POUT..	2	5	1	15	0	10	14	7	8	6	4	12	6	1	11	21													
PLAICE.....	12	25	5	53	1	54	69	21	39	45	19	37	21	4	95														
MACKEREL....	0	0	0	4	0	2	2	0	1	2	2	2	0	6															
SP. DOGFISH.	5	8	0	14	0	15	26	5	7	12	6	17	43																
POLLOCK.....	2	13	0	43	0	29	42	21	23	17	9	68																	
SMOOTH SKATE	7	8	2	16	0	21	22	9	16	11	27																		
ANGLER.....	11	20	4	33	1	37	46	5	27	53																			
WITCH.....	6	12	3	33	1	34	42	7	44																				
CUSK.....	7	16	2	23	1	21	23	36																					
SILVER HAKE.	16	37	6	60	1	69	106																						
WHITE HAKE..	17	35	6	50	1	74																							
EEL POUT....	1	1	1	1	1																								
REDFISH.....	13	27	6	83																									
GRENADIER...	7	7	7																										
ARGENTINE...	18	42																											
LONGFIN HAKE	19																												

Table 19. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Autumn 4W Number of Tows = 264

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	2	2	1	3	0	14	32	1	6	23	6	5	5	13	21	3	5	15	3	21	37	37	5	0	22	15	30	38	39
YELLOWTAIL..	8	3	3	14	0	37	84	2	46	66	42	19	7	16	107	9	26	29	10	92	124	119	10	4	46	38	90	136	
L.H. SCULPIN	5	5	2	12	0	31	68	3	39	49	32	20	5	13	80	9	21	23	8	71	91	92	8	3	39	37	101		
WINTER SKATE	1	0	0	1	0	12	28	0	13	21	11	4	0	8	25	3	9	10	3	26	36	37	2	1	20	40			
SEA RAVEN...	1	1	0	4	0	16	35	1	14	25	14	8	2	9	35	6	7	17	6	36	47	50	5	1	53				
SAND LAUNCE.	0	0	0	0	0	1	3	0	0	1	1	2	0	0	4	0	1	0	0	2	3	3	0	4					
LITTLE SKATE	0	0	0	1	0	3	8	0	3	5	1	1	0	0	6	0	1	7	1	2	10	10	10						
COD.....	9	11	2	43	0	59	112	13	67	68	46	50	15	23	139	22	37	38	16	121	164	182							
HADDOCK.....	13	31	2	61	0	84	145	21	78	87	52	73	18	24	163	28	39	35	18	130	211								
THORNY SKATE	28	28	12	65	0	68	111	18	78	77	55	48	8	12	141	24	31	23	17	166									
WOLFISH.....	1	1	0	12	0	9	16	3	15	7	8	15	1	2	21	5	5	4	23										
HERRING.....	0	0	0	10	0	25	33	1	16	21	5	17	5	8	29	8	4	40											
HALIBUT.....	6	5	3	11	0	17	28	9	20	23	17	15	3	5	36	7	44												
OCEAN POUT..	3	7	0	17	0	22	26	6	14	14	6	19	4	4	24	30													
PLAICE.....	37	44	11	83	0	92	148	21	104	93	65	71	15	13	210														
MACKEREL....	2	4	0	7	0	14	20	2	9	14	3	10	4	25															
SP. DOGFISH.	5	6	0	6	0	14	16	7	7	9	6	10	21																
POLLOCK.....	11	25	1	46	0	56	68	14	40	36	12	84																	
SMOOTH SKATE	16	12	8	25	0	23	45	9	36	36	68																		
ANGLER.....	28	31	12	41	0	68	92	14	58	114																			
WITCH.....	24	30	10	52	0	64	90	11	110																				
CUSK.....	13	16	7	18	0	22	27	31																					
SILVER HAKE.	39	51	12	81	0	108	186																						
WHITE HAKE..	33	42	11	62	0	114																							
EEL POUT....	0	0	0	0	0																								
REDFISH.....	33	39	14	93																									
GRENADIER...	14	11	14																										
ARGENTINE...	25	54																											
LONGFIN HAKE	42																												

Table 20. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Autumn 4Vs Number of Tows = 154

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOWTAIL..	3	1	1	9	0	8	21	0	16	6	14	8	0	4	51	1	4	7	5	51	42	50	1	7	9	15	19	54	
L.H. SCULPIN	2	0	1	4	0	3	13	0	5	3	8	3	0	2	19	1	3	4	4	20	16	19	0	6	4	10	21		
WINTER SKATE	3	0	2	7	0	8	17	0	9	6	12	4	1	1	20	0	8	2	4	22	17	21	0	2	4	23			
SEA RAVEN...	0	0	0	1	0	1	4	0	3	1	3	0	0	0	9	0	2	0	1	10	8	10	0	0	10				
SAND LAUNCE.	0	0	0	2	0	0	4	0	1	0	1	1	0	0	8	0	0	1	1	8	6	7	1	8					
LITTLE SKATE	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0	0	2	2	2	2						
COD.....	24	8	17	67	2	37	52	2	69	18	34	33	2	6	128	9	20	11	34	114	72	136							
HADDOCK.....	14	5	9	29	0	21	35	2	33	10	24	20	2	4	70	1	15	10	12	68	75								
THORNY SKATE	23	6	19	59	1	36	48	2	67	15	35	29	2	5	123	9	20	13	30	129									
WOLFISH.....	9	1	4	27	0	12	11	0	23	4	6	11	1	2	36	5	6	1	36										
HERRING.....	0	0	0	4	0	0	3	0	7	0	6	4	0	1	13	1	0	13											
HALIBUT.....	13	4	9	13	0	18	18	1	15	7	9	5	1	0	20	1	22												
OCEAN POUT..	2	1	1	10	0	4	4	0	10	1	3	1	0	1	13	13													
PLAICE.....	30	7	21	70	2	44	57	1	83	17	42	30	2	6	146														
MACKEREL....	2	1	1	3	0	2	3	0	3	1	1	2	0	7															
SP. DOGFISH.	2	0	1	2	0	1	1	0	2	1	2	1	2																
POLLOCK.....	9	5	7	23	0	14	13	1	15	4	9	33																	
SMOOTH SKATE	14	3	8	24	2	21	23	0	28	5	42																		
ANGLER.....	8	1	9	12	1	14	16	0	13	21																			
WITCH.....	28	3	19	53	2	38	39	0	83																				
CUSK.....	1	1	0	2	0	1	1	2																					
SILVER HAKE.	20	6	17	34	2	33	60																						
WHITE HAKE..	28	9	24	38	2	49																							
EEL POUT....	0	0	0	1	2																								
REDFISH.....	31	10	24	76																									
GRENADIER...	21	6	25																										
ARGENTINE...	5	10																											
LONGFIN HAKE	33																												

Table 21. GROUNDFISH SPECIES ASSOCIATION MATRIX (NUMBER OF CO-OCCURRENCES)

1980-84 Autumn 4Vn Number of Tows = 39

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	1	0	2	1	0	0	0	1	1	0	0	2	1	1	1	2	2	2	2	0	0	1	0	0	1	2
YELLOWTAIL..	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	1	0	1	1	
L.H. SCULPIN	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	0	0	1	0	1		
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1			
SEA RAVEN...	0	0	0	1	0	3	2	0	0	0	1	2	0	0	2	1	1	3	1	2	3	3	0	0	3				
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0					
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
COD.....	4	1	6	17	0	20	8	0	14	3	9	12	0	3	27	4	2	14	13	23	15	31							
HADDOCK.....	2	0	2	10	0	13	5	0	8	1	5	6	0	1	12	3	2	4	12	11	15								
THORNY SKATE	7	0	7	14	0	16	6	0	13	3	8	10	0	2	24	4	2	11	10	27									
WOLFISH.....	1	0	1	8	0	10	4	0	6	0	3	7	0	2	9	2	2	4	13										
HERRING.....	1	0	1	5	0	8	5	0	3	0	2	6	0	3	11	2	1	14											
HALIBUT.....	0	0	0	1	0	2	1	0	1	0	1	0	0	0	2	0	2												
OCEAN POUT..	0	0	0	2	0	4	0	0	0	0	3	3	0	0	4	4													
PLAICE.....	8	1	9	19	0	21	7	0	16	4	10	8	0	1	32														
MACKEREL....	0	0	0	0	0	1	0	0	0	0	0	3	0	3															
SP. DOGFISH.	0	0	0	0	0	0	0	0	0	0	0	0	0																
POLLOCK.....	0	0	1	6	0	8	2	0	3	1	3	12																	
SMOOTH SKATE	3	1	4	6	0	8	1	0	6	2	11																		
ANGLER.....	2	1	3	4	0	4	2	0	3	4																			
WITCH.....	10	0	10	17	0	16	7	0	20																				
CUSK.....	0	0	0	0	0	0	0	0																					
SILVER HAKE.	4	0	3	8	0	9	9																						
WHITE HAKE..	9	1	10	20	0	25																							
EEL POUT....	0	0	0	0	0																								
REDFISH.....	11	1	12	24																									
GRENADIER...	10	1	12																										
ARGENTINE...	0	1																											
LONGFIN HAKE	11																												

Table 22. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1970-79 Summer 4X Bay of Fundy Number of Tows = 142

	LONGFIN	ARGENTINE	GRENADIER	REDFISH	EEL POUT	SILVER HAKE	WHITE HAKE	SMOOTH SKATE	ANGLER	WITCH	CUSK	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	HADDOCK	COD	THORNY SKATE	LITTLE SKATE	WINTER SKATE	SEA RAVEN	SAND LAUNCE	YELLOWTAIL	L.H. SCULPIN	WINTER FL
WINTER FL...	0	0	0	32	44	43	46	13	33	43	35	41	48	100	33	46	100	53	70	45	51	51	58	100	62	76	61	88	100
YELLOWTAIL..	0	0	0	0	22	7	6	0	7	13	5	4	5	50	7	3	24	6	9	6	7	5	8	0	7	10	8	100	11
L.H. SCULPIN	0	0	0	68	44	64	60	31	52	57	64	66	64	50	49	70	88	68	79	61	67	66	75	0	76	79	100	88	83
WINTER SKATE	0	0	0	13	22	21	21	6	12	22	9	18	24	50	14	17	35	19	18	17	23	21	38	100	26	100	26	38	33
SEA RAVEN...	0	0	0	61	78	66	67	25	47	52	67	68	69	100	49	75	88	70	79	65	71	71	83	100	100	86	80	88	89
SAND LAUNCE.	0	0	0	0	11	1	0	0	0	0	0	2	1	0	0	0	0	2	0	1	2	2	0	100	2	7	0	0	3
LITTLE SKATE	0	0	0	9	11	18	22	0	12	13	11	16	19	0	7	18	24	23	12	14	17	18	100	0	21	31	20	25	21
COD.....	0	100	0	95	100	92	90	94	88	83	91	96	88	100	86	93	100	91	100	93	96	100	96	100	97	93	96	88	100
HADDOCK.....	0	100	0	80	78	85	79	94	80	74	76	89	88	100	75	85	94	87	97	84	100	90	88	100	92	97	91	100	94
THORNY SKATE	0	100	0	89	89	80	83	94	90	96	93	80	73	100	89	80	71	77	76	100	75	78	63	50	75	66	74	75	74
WOLFISH.....	0	100	0	32	33	22	16	38	20	22	16	30	23	0	21	23	47	23	100	23	26	25	17	0	27	21	29	38	35
HERRING.....	0	0	0	27	11	32	38	19	38	52	38	38	41	50	35	39	47	100	36	38	38	37	50	50	39	34	40	38	42
HALIBUT.....	0	0	0	5	33	10	10	0	7	22	9	13	13	50	11	11	100	15	24	11	13	13	17	0	16	21	17	50	26
OCEAN POUT..	0	0	0	54	22	51	48	25	50	74	56	52	52	50	53	100	47	53	48	52	49	51	54	0	56	41	56	25	50
PLAICE.....	0	100	0	46	56	45	48	50	68	65	56	41	35	0	100	42	35	38	36	47	35	38	17	0	29	28	31	50	29
MACKEREL....	0	0	0	0	0	1	2	0	0	4	2	0	1	100	0	1	6	2	0	2	2	2	0	0	2	3	1	13	3
SP. DOGFISH.	0	100	0	57	44	59	56	63	47	43	49	59	100	50	53	63	65	66	61	58	62	58	67	50	62	72	61	50	62
POLLOCK.....	0	0	0	52	33	42	38	63	47	48	35	100	38	0	40	41	41	40	52	41	41	42	38	50	40	34	41	25	35
SMOOTH SKATE	0	0	0	46	67	42	41	31	45	52	100	34	31	50	54	44	29	40	27	47	34	38	25	0	39	17	39	38	29
ANGLER.....	0	0	0	16	11	18	21	13	25	100	22	20	12	50	26	24	29	23	15	20	14	15	13	0	13	17	14	38	15
WITCH.....	0	100	0	54	44	46	52	69	100	65	49	50	33	0	72	42	24	43	36	50	39	41	29	0	29	24	34	50	30
CUSK.....	0	100	0	20	0	13	10	100	18	9	9	18	12	0	14	6	0	6	18	14	12	12	0	0	4	3	6	0	3
SILVER HAKE.	0	0	0	48	44	54	100	38	55	57	47	43	41	50	53	42	35	45	30	48	41	44	58	0	44	45	42	50	44
WHITE HAKE..	0	100	0	89	89	100	97	94	88	91	87	86	78	50	89	82	65	70	76	83	80	81	88	50	79	83	81	100	74
EEL POUT....	0	0	0	4	100	7	6	0	7	4	11	5	5	0	9	3	18	2	9	7	6	7	4	50	7	7	4	25	6
REDFISH.....	0	100	0	100	22	44	43	69	50	39	47	52	37	0	46	42	18	28	55	46	37	41	21	0	36	24	42	0	27
GRENADIER...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ARGENTINE...	0	100	0	2	0	1	0	6	2	0	0	0	1	0	2	0	0	0	3	1	1	1	0	0	0	0	0	0	0
LONGFIN HAKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 23. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1970-79 Summer 4X excluding Bay of Fundy Number of Tows = 245

	LONGFIN	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	1	0	0	0	1	1	1	1	1	5	0	1	6	4	0	3	2	2	2	0	0	5	6	4	5	100
YELLOWTAIL..	7	12	22	5	0	10	17	12	21	21	21	17	26	21	21	16	49	5	25	26	26	28	88	0	31	64	41	100	75
L.H. SCULPIN	13	14	11	17	33	19	22	25	31	23	40	25	21	7	32	38	43	10	41	33	32	37	50	0	59	47	100	51	75
WINTER SKATE	20	12	11	8	0	11	15	12	15	13	19	6	26	7	16	16	22	0	13	15	16	18	25	0	10	100	24	40	50
SEA RAVEN...	0	3	11	15	0	10	8	12	22	13	19	16	21	7	14	13	24	10	29	18	17	22	13	0	100	11	33	21	50
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LITTLE SKATE	0	5	0	2	0	3	5	2	1	4	4	3	0	0	2	3	5	0	1	3	4	3	100	0	3	6	6	12	0
COD.....	27	41	0	51	33	50	52	63	59	47	75	70	74	43	70	66	96	55	90	74	80	100	63	0	97	86	93	88	100
HADDOCK.....	33	70	11	69	33	73	74	85	72	68	87	94	79	86	82	88	100	65	97	88	100	97	100	0	95	94	97	96	100
THORNY SKATE	73	64	89	68	67	74	72	81	81	77	81	74	79	79	77	84	74	60	74	100	70	70	63	0	79	69	80	75	75
WOLFISH.....	7	18	0	37	33	31	30	35	49	32	49	44	47	43	50	44	59	35	100	47	49	55	13	0	79	39	63	47	75
HERRING.....	7	6	0	17	33	16	15	9	19	19	7	16	26	14	10	6	3	100	7	7	6	6	0	0	5	0	3	2	0
HALIBUT.....	0	14	0	10	0	11	16	21	18	22	25	23	32	7	27	19	100	10	41	33	35	40	50	0	46	44	46	63	75
OCEAN POUT..	33	18	33	21	33	19	19	23	18	16	19	19	5	7	18	100	8	10	13	16	13	12	13	0	10	14	17	9	50
PLAICE.....	80	58	89	73	100	77	76	68	88	78	73	69	53	57	100	81	53	75	68	67	56	57	38	0	51	64	67	54	25
MACKEREL....	7	9	0	9	0	9	11	7	10	12	7	9	0	100	6	3	1	10	6	7	6	3	0	0	3	3	1	5	0
SP. DOGFISH.	0	9	0	10	0	9	8	8	7	9	9	8	100	0	7	3	8	25	8	9	7	8	0	0	10	14	6	9	25
POLLOCK.....	20	41	11	45	33	51	38	46	43	36	31	100	32	50	37	47	24	60	32	34	34	31	25	0	31	14	27	23	25
SMOOTH SKATE	33	27	11	37	33	36	35	32	43	36	100	27	32	36	34	41	23	25	31	32	27	28	38	0	33	36	39	25	25
ANGLER.....	47	38	44	49	0	56	51	39	60	100	42	36	37	64	41	38	23	75	23	35	25	20	38	0	26	28	26	28	25
WITCH.....	47	23	67	48	67	47	42	35	100	53	43	38	26	50	41	38	16	65	31	33	23	23	13	0	38	28	30	25	25
CUSK.....	60	58	44	58	67	60	53	100	51	51	48	60	42	50	46	72	28	45	33	48	40	35	25	0	31	33	36	21	25
SILVER HAKE.	93	77	78	77	67	84	100	65	75	79	63	60	47	93	63	72	26	90	34	51	42	35	75	0	26	50	37	35	0
WHITE HAKE..	87	71	100	79	100	100	76	66	75	78	58	71	53	71	57	66	16	85	32	48	37	31	38	0	28	33	29	19	0
EEL POUT....	7	3	22	3	100	3	2	2	3	0	1	1	0	0	2	3	0	5	1	1	0	1	0	0	0	0	1	0	0
REDFISH.....	93	67	100	100	100	75	66	60	72	65	57	60	53	64	51	66	14	85	36	41	33	30	25	0	38	22	24	9	25
GRENADIER...	40	12	100	9	67	8	6	4	9	5	1	1	0	0	6	9	0	0	0	5	0	0	0	0	3	3	1	4	0
ARGENTINE...	80	100	89	43	67	44	42	36	22	32	27	35	32	43	26	38	12	20	11	25	22	15	38	0	5	22	13	14	0
LONGFIN HAKE	100	18	67	14	33	12	12	9	10	9	7	4	0	7	8	16	0	5	1	7	2	2	0	0	0	8	3	2	0

Table 24. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1970-79 Summer 4W Number of Tows = 445

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	SP. DOGFISH	POLLOCK	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	2	0	3	10	0	11	8	12	5	0	17	11	18	7	12	4	11	9	16	33	33	29	37	24	19	100
YELLOWTAIL..	14	16	9	28	36	35	52	19	54	53	62	34	57	51	60	63	70	51	61	61	65	76	100	80	91	92	86	100	98
L.H. SCULPIN	26	10	22	24	18	29	42	17	40	44	53	12	14	39	44	55	43	32	37	46	40	53	100	87	79	87	100	63	94
WINTER SKATE	2	0	0	5	0	6	14	2	13	16	17	9	0	22	13	20	16	20	4	13	15	19	67	47	31	100	28	22	46
SEA RAVEN...	2	0	4	10	0	14	23	2	27	26	30	22	14	37	27	40	29	20	34	28	30	37	67	47	100	62	51	43	71
SAND LAUNCE.	7	0	4	1	0	2	3	0	2	4	3	2	0	7	3	6	1	0	1	3	3	4	17	100	6	12	7	5	10
LITTLE SKATE	0	0	0	0	0	1	1	0	1	2	3	0	0	2	1	3	1	0	0	1	1	2	100	7	3	7	3	2	4
COD.....	12	27	0	43	73	43	57	39	66	59	71	69	43	56	68	66	82	63	84	70	81	100	100	87	94	97	86	90	98
HADDOCK.....	14	46	9	40	36	53	53	52	52	45	52	83	71	76	52	65	75	61	78	54	100	65	33	40	61	60	52	61	44
THORNY SKATE	83	67	83	72	91	76	76	78	82	79	87	67	86	59	78	82	80	68	75	100	77	79	83	60	80	73	84	81	79
WOLFISH.....	2	11	4	17	9	15	12	17	15	16	15	36	43	17	14	24	20	15	100	15	22	19	0	7	19	5	13	16	6
HERRING.....	0	5	0	14	0	13	10	4	13	12	10	9	14	10	10	16	11	100	9	8	10	9	0	0	7	13	7	8	10
HALIBUT.....	19	17	22	14	36	22	17	28	20	26	24	31	0	22	19	27	100	24	27	21	28	24	17	7	22	23	20	24	13
OCEAN POUT..	24	10	17	21	9	25	25	13	24	26	29	16	43	24	20	100	27	34	31	22	24	20	50	33	30	30	26	22	33
PLAICE.....	81	79	78	89	100	84	86	65	89	86	90	69	100	80	100	84	80	90	79	85	80	83	67	80	84	77	87	87	85
MACKEREL....	2	16	4	8	0	12	12	15	10	9	5	19	14	100	9	11	10	10	10	7	13	8	17	20	13	15	9	8	15
SP. DOGFISH.	0	5	0	3	0	3	2	2	2	1	2	2	100	2	2	3	0	2	4	2	2	1	0	0	1	0	1	2	0
POLLOCK.....	5	21	0	14	9	14	10	35	10	13	10	100	14	27	11	10	20	12	31	12	20	13	0	7	11	8	4	8	6
SMOOTH SKATE	36	25	22	35	36	38	40	31	40	38	100	26	43	17	35	46	39	37	31	37	31	34	67	27	36	40	41	35	35
ANGLER.....	55	44	57	43	45	47	43	39	47	100	43	34	29	37	38	47	46	46	37	37	30	31	50	47	34	42	38	33	27
WITCH.....	43	52	35	57	82	57	53	30	100	64	61	38	71	54	53	58	48	68	48	53	47	48	50	27	50	47	46	46	48
CUSK.....	29	30	48	17	0	17	12	100	7	13	12	33	14	20	10	8	17	5	13	12	12	7	0	0	1	2	5	4	0
SILVER HAKE.	76	76	57	69	64	78	100	59	64	69	71	45	86	73	60	73	51	63	48	58	57	49	50	47	50	58	58	52	54
WHITE HAKE..	76	83	70	67	73	100	57	59	50	56	50	45	71	54	43	53	47	59	42	42	42	27	17	27	23	18	29	26	10
EEL POUT....	10	3	0	5	100	4	3	0	4	3	3	2	0	0	3	1	4	0	1	3	2	3	0	0	0	0	1	2	0
REDFISH.....	83	71	91	100	82	60	45	54	44	46	41	40	71	32	41	39	26	56	43	36	28	24	0	13	14	15	22	19	6
GRENADIER...	50	16	100	12	0	9	5	20	4	8	3	0	0	2	5	4	6	0	1	6	1	0	0	7	1	0	3	1	0
ARGENTINE...	40	100	43	27	18	28	19	35	15	17	11	22	43	24	14	7	12	7	10	12	12	6	0	0	0	0	3	4	0
LONGFIN HAKE	100	27	91	21	36	17	12	22	8	14	10	3	0	2	9	11	9	0	1	10	3	2	0	20	1	2	6	2	0

Table 25. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1970-79 Summer 4Vs

Number of Tows = 291

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	100	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5	0	1	1	100
YELLOWTAIL..	100	83	69	87	50	80	41	25	42	29	39	27	41	46	89	50	42	39	27	41	25	54	76	68	77	75	64	55	12
L.H. SCULPIN	100	69	80	95	45	80	35	0	41	25	33	23	0	25	56	13	16	23	23	24	0	26	16	14	21	13	8	10	4
WINTER SKATE	15	29	19	23	28	100	15	100	13	11	14	12	26	0	33	10	7	18	0	4	10	29	12	0	10	40	100	29	19	0
SEA RAVEN...	100	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	8	0	6	7	18	9	0	0	100	28	23	15	100
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	7	0	0	7	8	4	8	0	100	0	7	13	13	0
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COD.....	100	91	93	93	94	100	95	100	79	71	80	81	100	100	79	70	76	68	77	75	64	78	82	70	76	75	64	55	60
HADDOCK.....	100	25	29	48	45	10	0	20	39	23	17	30	15	37	0	67	17	13	39	100	23	17	100	20	0	10	45	48	29	25	0
THORNY SKATE	100	89	93	94	96	100	100	95	85	100	92	89	100	100	90	87	82	100	85	100	92	89	100	100	95	93	94	96	100
WOLFISH.....	100	23	33	28	0	25	20	10	20	20	100	23	33	23	20	29	50	100	23	33	28	0	25	20	10	20	20	100	16	35	13	30	23	22	6	38	23	25	22	26	50	33	23	20	29	50	100	23	33	28	0	25	20	10	20	20	100
HERRING.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	0	3	100	1	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALIBUT.....	100	50	15	12	31	12	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCEAN POUT..	100	8	0	4	5	4	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLAICE.....	100	87	90	92	91	0	100	100	86	93	94	100	100	89	100	80	87	100	85	90	92	91	0	100	100	86	93	94	100	66	70	69	82	95	79	96	63	90	82	87	79	100	89	100	80	87	100	85	90	92	91	0	100	100	86	93	94	100
MACKEREL....	100	4	3	12	4	0	0	15	10	7	6	0	0	100	3	0	5	50	4	3	12	4	0	0	15	10	7	6	0	0	0	0	1	0	0	1	0	0	0	1	0	0	100	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SP. DOGFISH.	100	7	7	14	6	100	0	5	17	4	6	0	0	100	0	1	0	3	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLLOCK.....	100	7	7	14	6	100	0	5	17	4	6	0	0	100	0	1	0	3	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SMOOTH SKATE	100	36	40	47	0	31	36	31	31	0	15	35	41	33	31	0	34	40	47	0	31	36	31	31	0	15	35	41	33	31	0	48	35	59	38	27	52	54	0	37	55	100	11	50	11	34	40	47	0	31	36	31	31	0	15	35	41	33	31	0
ANGLER.....	100	58	64	57	59	0	35	75	66	61	58	100	74	62	67	74	100	58	64	57	59	0	35	75	66	61	58	100	36	25	36	21	5	31	26	13	20	100	24	16	0	33	14	40	45	0	15	14	27	13	0	10	5	21	14	9	0
WITCH.....	100	4	3	4	3	100	0	0	3	0	2	0	74	55	69	69	77	68	70	13	100	80	66	42	50	78	62	67	74	100	58	64	57	59	0	35	75	66	61	58	100	74	55	69	69	77	68	70	13	100	80	66	42	50	78	62	67
CUSK.....	100	7	6	8	0	5	0	0	3	0	2	0	12	30	15	6	0	7	2	100	1	2	0	21	0	0	2	20	11	0	4	3	4	3	100	0	0	3	0	2	0	12	30	15	6	0	7	2	100	1	2	0	21	0	0	2	20
SILVER HAKE.	100	18	29	18	0	15	20	41	20	23	0	26	20	23	16	25	20	31	100	21	20	34	20	20	0	26	20	23	31	100	27	27	29	26	100	5	20	34	20	20	0	78	70	82	46	27	100	50	75	33	61	44	58	50	11	27	40
WHITE HAKE..	100	7	13	6	11	0	5	0	0	1	2	0	6	0	0	8	0	0	50	7	7	6	8	0	5	0	0	1	2	0	6	0	9	2	6	5	0	0	8	0	0	50	7	7	6	8	0	5	0	0	1	2	0	13	100	7	2
EEL POUT....	100	37	46	100	20	15	24	24	21	0	24	20	15	24	17	5	0	17	4	5	0	3	2	0	5	0	17	3	5	0	10	7	8	5	0	0	5	0	3	2	0	16	37	0	27	75	15	32	23	21	0	0	10	27	24	0	7
REDFISH.....	100	58	46	37	46	100	20	15	24	24	21	0	94	80	95	100	82	72	41	100	53	66	52	68	50	22	43	60	63	0	58	46	37	46	100	20	15	24	24	21	0	68	65	100	27	0	37	17	75	15	32	23	21	0	0	10	27
GRENADIER...	100	7	13	6	11	0	5	0	0	3	2	0	68	65	100	27	0	37	17	75	15	32	23	21	0	0	10	27	24	0	7	13	6	11	0	5	0	17	4	5	0	26	100	33	12	0	16	7	75	6	11	7	11	0	0	5	33
ARGENTINE...	100	10	17	8	13	100	0	0	17	3	5	0	100	65	87	34	14	45	24	75	21	41	24	37	0	0	13	27	29	0	11	17	8	13	100	0	0	17	3	5	0																
LONGFIN HAKE																																																																	

Table 26. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1970-79 Summer 4Vn Number of Tows = 73

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOWTAIL..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L.H. SCULPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEA RAVEN...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COD.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HADDOCK.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THORNY SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WOLFISH.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HERRING.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALIBUT.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCEAN POUT..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLAICE.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SP. DOGFISH.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLLOCK.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SMOOTH SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANGLER.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WITCH.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CUSK.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SILVER HAKE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WHITE HAKE..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEL POUT....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDFISH.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRENADIER...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ARGENTINE...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONGFIN HAKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 27. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Spring 4W Number of Tows = 239

	LONGFIN	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	100	64	100	91	0	91	100	36	77	86	50	9	18	5	73	14	68	5	5	14	5	0	0	0	9	18	5	0
YELLOWTAIL..	91	64	100	91	0	91	100	40	82	91	55	27	0	23	82	9	82	9	0	75	50	3	0	8	15	17	9	0
L.H. SCULPIN	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
WINTER SKATE	23	47	14	100	100	53	100	100	100	53	51	50	30	19	73	13	46	20	6	61	27	4	0	11	53	27	13	0
SEA RAVEN...	91	64	100	91	0	91	100	40	82	91	55	27	0	23	82	9	82	9	0	75	50	3	0	8	15	17	9	0
SAND LAUNCE.	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
LITTLE SKATE	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
COD.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
HADDOCK.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
THORNY SKATE	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
WOLFISH.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
HERRING.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
HALIBUT.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
OCEAN POUT..	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
PLAICE.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
MACKEREL....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
SP. DOGFISH.	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
POLLOCK.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
SMOOTH SKATE	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
ANGLER.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
WITCH.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
CUSK.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
SILVER HAKE.	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
WHITE HAKE..	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
EEL POUT....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
REDFISH.....	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
GRENADIER...	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
ARGENTINE...	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0
LONGFIN HAKE	23	47	14	55	1	58	81	45	70	53	34	30	0	12	74	0	38	20	6	61	27	4	0	11	53	27	13	0

Table 28. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Spring 4Vs Number of Tows = 130

	LONG FIN	ARGENTINE	GREENDIER	RED FISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	SEA RAVEN	WINTER SKATE	LITTLE SKATE	SAND LAUNCE	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	2	0	0	2	0	25	2	0	2	2	0	0	0	0	0	2	1	2	1	0	0	0	2	2	0	100
YELLOWTAIL..	13	18	14	31	0	34	31	25	37	36	54	29	25	0	52	14	59	33	57	52	52	49	100	83	67	67	83	100	0
L.H. SCULPIN	19	27	14	23	0	22	19	50	23	20	30	20	25	0	36	14	21	22	49	37	32	39	100	67	53	44	100	58	100
WINTER SKATE	31	36	43	38	0	49	31	75	43	48	48	37	50	0	44	29	69	22	59	44	61	45	0	42	87	100	54	58	100
SEA RAVEN...	0	0	0	2	0	10	0	0	8	4	12	10	0	0	12	14	3	0	14	12	13	12	0	0	100	23	17	15	0
SAND LAUNCE.	6	0	7	2	0	2	0	0	2	0	8	7	0	0	10	0	7	0	12	10	7	7	0	100	0	9	17	15	0
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	2	2	100	0	0	0	4	3	0
COD.....	75	91	64	90	0	80	77	75	85	76	80	83	75	0	80	86	76	78	90	79	86	100	100	58	80	82	89	78	100
HADDOCK.....	31	36	29	42	0	49	38	75	51	56	62	61	42	0	43	29	76	56	65	45	100	46	50	33	47	60	39	45	100
THORNY SKATE	88	73	86	88	0	85	81	100	95	88	98	88	75	0	94	86	97	89	96	100	98	92	100	100	100	95	98	97	100
WOLFISH.....	19	36	21	38	0	39	23	75	40	28	48	41	25	0	38	14	48	22	100	39	57	42	0	50	47	51	52	43	100
HERRING.....	0	9	0	12	0	5	8	25	8	4	6	15	8	0	7	29	10	100	4	7	9	7	0	0	0	4	4	5	0
HALIBUT.....	31	18	36	23	0	34	31	50	32	44	38	32	25	0	22	0	100	33	29	23	39	21	0	17	7	35	13	26	0
OCEAN POUT..	6	9	0	8	0	2	8	0	6	0	2	10	0	0	5	100	0	22	2	5	4	6	0	0	7	4	2	2	0
PLAICE.....	94	91	100	90	0	88	92	75	91	92	94	90	100	0	100	86	93	100	94	94	93	94	100	100	100	95	96	97	0
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SP. DOGFISH.	38	36	43	17	0	22	27	25	15	20	10	12	100	0	10	0	10	11	6	7	9	9	0	0	0	11	7	5	0
POLLOCK.....	56	64	57	46	0	51	42	75	43	44	38	100	42	0	30	57	45	67	35	30	45	33	0	25	27	26	17	18	100
SMOOTH SKATE	38	36	29	46	0	46	42	75	54	44	100	46	42	0	39	14	66	33	49	40	55	38	0	33	40	42	33	42	100
ANGLER.....	50	45	71	33	0	46	54	25	37	100	22	27	42	0	19	0	38	11	14	18	25	18	0	0	7	21	11	14	0
WITCH.....	88	91	86	81	0	85	85	75	100	96	70	68	83	0	48	57	72	56	53	51	59	53	0	8	33	49	33	37	100
CUSK.....	6	9	7	8	0	10	8	100	5	4	6	7	8	0	2	0	7	11	6	3	5	3	0	0	0	5	4	2	100
SILVER HAKE.	81	73	71	37	0	54	100	50	34	56	22	27	58	0	20	29	28	22	12	17	18	19	0	0	0	14	11	12	0
WHITE HAKE..	94	100	100	56	0	100	85	100	54	76	38	51	75	0	30	14	48	22	33	29	36	32	0	8	27	35	20	22	100
EEL POUT....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDFISH.....	94	91	93	100	0	71	73	100	65	68	48	59	75	0	39	57	41	67	41	38	39	45	0	8	7	35	26	25	100
GRENADIER...	75	45	100	25	0	34	38	25	18	40	8	20	50	0	11	0	17	0	6	10	7	9	0	8	0	11	4	3	0
ARGENTINE...	38	100	36	19	0	27	31	25	15	20	8	17	33	0	8	14	7	11	8	7	7	10	0	0	0	7	7	3	0
LONGFIN HAKE	100	55	86	29	0	37	50	25	22	32	12	22	50	0	12	14	17	0	6	11	9	12	0	8	0	9	7	3	0

Table 29. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Spring 4Vn Number of Tows = 9

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YELLOWTAIL..	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
L.H. SCULPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
SEA RAVEN...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
COD.....	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100	100	0	100	100	100								
HADDOCK.....	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100	100	0	100	100									
THORNY SKATE	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100	100	0	100										
WOLFISH.....	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100	100	0											
HERRING.....	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100	100												
HALIBUT.....	0	0	0	100	0	100	100	0	100	100	100	100	0	0	100													
OCEAN POUT..	0	0	0	100	0	100	100	0	100	100	100	100	0	0														
PLAICE.....	0	0	0	100	0	100	100	0	100	100	100	100	0															
MACKEREL....	0	0	0	100	0	100	100	0	100	100	100	100																
SP. DOGFISH.	0	0	0	100	0	100	100	0	100	100	100																	
POLLOCK.....	0	0	0	100	0	100	100	0	100	100																		
SMOOTH SKATE	0	0	0	100	0	100	100	0	100																			
ANGLER.....	0	0	0	100	0	100	100	0																				
WITCH.....	0	0	0	100	0	100	100																					
CUSK.....	0	0	0	100	0	100	100																					
SILVER HAKE.	0	0	0	100	0	100																						
WHITE HAKE..	0	0	0	100	0	100																						
EEL POUT....	0	0	0	100	0																							
REDFISH.....	0	0	0	100																								
GRENADIER...	0	0	0																									
ARGENTINE...	0	0	0																									
LONGFIN HAKE	0	0	0																									

Table 30. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Summer 4X Bay of Fundy Number of Tows = 78

	LONGFIN HAKE	ARGENTINE	GREENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	100	0	33	100	62	64	0	34	64	40	64	65	100	49	64	100	81	86	58	68	65	81	100	79	94	77	100	100
YELLOWTAIL..	0	100	0	0	0	17	19	0	16	29	5	8	16	100	24	14	50	17	29	14	17	15	6	0	17	11	17	100	22
L.H. SCULPIN	0	100	0	67	100	73	69	33	53	64	60	69	61	100	54	70	67	75	95	67	74	68	88	50	83	78	100	82	80
WINTER SKATE	0	0	0	0	100	20	22	0	3	7	5	19	22	0	7	14	50	36	10	14	25	23	44	100	26	100	26	18	33
SEA RAVEN...	0	100	0	72	100	77	67	0	53	79	75	75	71	100	61	74	67	83	95	74	77	77	75	100	100	83	91	91	90
SAND LAUNCE.	0	0	0	0	100	2	6	0	0	0	5	6	4	0	2	0	17	3	0	2	2	3	6	100	3	11	2	0	4
LITTLE SKATE	0	0	0	0	100	20	28	0	19	0	15	19	27	0	10	18	17	33	14	16	18	17	100	50	21	39	26	9	25
COD.....	0	100	0	100	100	95	92	100	88	86	85	94	88	100	95	92	100	92	100	95	95	100	75	100	95	89	91	100	90
HADDOCK.....	0	100	0	94	100	87	78	100	75	93	75	83	80	100	83	86	83	92	100	84	100	87	75	50	86	89	91	100	86
THORNY SKATE	0	100	0	83	0	78	75	100	84	79	95	81	73	50	90	86	33	64	86	100	74	76	56	50	72	44	72	73	65
WOLFISH.....	0	100	0	39	0	32	28	33	22	21	30	28	22	0	27	34	33	25	100	32	32	30	19	0	34	11	38	55	35
HERRING.....	0	100	0	33	100	43	61	33	34	43	15	36	49	100	32	40	17	100	43	40	51	46	75	50	52	72	51	55	57
HALIBUT.....	0	0	0	0	0	5	8	0	6	0	5	6	6	0	10	8	100	3	10	4	8	8	6	50	7	17	8	27	12
OCEAN POUT..	0	100	0	61	0	68	64	33	78	57	75	58	55	50	76	100	67	56	81	75	66	65	56	0	64	39	66	64	63
PLAICE.....	0	100	0	61	0	57	67	100	81	71	80	56	53	100	100	62	67	36	52	65	52	55	25	50	43	17	42	91	39
MACKEREL....	0	0	0	0	0	3	6	0	3	14	0	0	4	100	5	2	0	6	0	2	3	3	0	0	3	0	4	18	4
SP. DOGFISH.	0	0	0	56	100	63	61	100	66	71	55	53	100	100	63	54	50	67	52	63	60	61	81	100	60	61	57	73	63
POLLOCK.....	0	0	0	56	100	50	53	100	47	43	55	100	39	0	49	42	33	36	48	51	46	48	44	100	47	39	47	27	45
SMOOTH SKATE	0	0	0	33	0	25	25	33	31	43	100	31	22	0	39	30	17	8	29	33	23	24	19	50	26	6	23	9	16
ANGLER.....	0	0	0	17	0	17	11	0	16	100	30	17	20	100	24	16	0	17	14	19	20	17	0	0	19	6	17	36	18
WITCH.....	0	100	0	44	0	45	56	67	100	36	50	42	43	50	63	50	33	31	33	47	37	39	38	0	29	6	32	45	22
CUSK.....	0	0	0	17	0	5	6	100	6	0	5	8	6	0	7	2	0	3	5	5	5	4	0	0	0	0	2	0	0
SILVER HAKE.	0	100	0	44	100	52	100	67	63	29	45	53	45	100	59	46	50	61	48	47	43	46	63	100	41	44	47	64	45
WHITE HAKE..	0	100	0	89	100	100	86	100	84	71	75	83	78	100	83	82	50	72	90	82	80	80	75	50	79	67	83	91	73
EEL POUT....	0	0	0	0	100	2	3	0	0	0	0	3	2	0	0	0	0	3	0	0	2	1	6	50	2	6	2	0	2
REDFISH.....	0	0	0	100	0	27	22	100	25	21	30	28	20	0	27	22	0	17	33	26	26	25	0	0	22	0	23	0	12
GRENADIER...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ARGENTINE...	0	100	0	0	0	2	3	0	3	0	0	0	0	0	2	2	0	3	5	2	2	1	0	0	2	0	2	9	2
LONGFIN HAKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 31. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Summer 4X excluding Bay of Fundy Number of Tows = 137

	LONGFIN	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL.
WINTER FL...	0	0	0	0	0	2	7	0	5	9	4	2	11	0	6	17	11	15	12	6	7	9	33	25	17	50	15	23	100
YELLOWTAIL..	0	11	0	5	0	2	14	13	14	18	11	16	35	0	18	22	37	8	32	22	25	28	83	75	43	75	41	100	78
L.H. SCULPIN	7	14	25	25	0	21	28	30	25	24	48	21	39	0	30	52	34	31	50	37	31	36	33	50	70	63	100	52	67
WINTER SKATE	0	6	0	2	0	0	5	5	2	6	0	2	9	0	2	9	8	8	8	7	6	7	33	25	9	100	13	19	44
SEA RAVEN...	0	6	0	14	0	12	9	17	9	9	33	14	26	0	17	48	24	15	38	22	19	21	17	0	100	25	41	32	44
SAND LAUNCE.	0	0	0	0	0	0	0	3	0	3	0	0	7	0	2	0	0	8	2	1	3	4	17	100	0	13	5	10	11
LITTLE SKATE	7	6	0	2	0	2	5	5	2	6	0	0	4	0	4	4	5	0	2	5	4	4	100	25	4	25	5	16	22
COD.....	21	50	25	57	0	48	49	60	59	47	59	72	76	100	65	57	82	54	88	76	77	100	67	100	91	88	90	87	100
HADDOCK.....	57	86	50	83	0	81	81	88	84	76	81	95	96	100	88	87	95	92	100	93	100	98	83	100	100	100	100	100	100
THORNY SKATE	79	58	50	65	100	65	60	67	61	56	81	67	65	100	68	70	74	54	76	100	65	66	67	25	83	75	82	61	56
WOLFISH.....	7	19	0	30	0	33	23	30	36	21	44	35	39	100	45	57	53	38	100	44	40	45	17	25	83	50	64	52	67
HERRING.....	0	8	0	13	0	17	19	15	18	18	15	12	11	0	11	26	3	100	10	8	10	7	0	25	9	13	10	3	22
HALIBUT.....	36	19	25	17	0	17	18	20	25	15	19	19	24	100	27	35	100	8	40	33	29	32	33	0	39	38	33	45	44
OCEAN POUT..	14	14	0	25	100	23	25	20	25	38	44	19	22	0	22	100	21	46	26	19	16	13	17	0	48	25	31	16	44
PLAICE.....	86	56	100	75	100	83	68	65	89	79	78	72	57	100	100	78	58	69	74	65	58	54	50	50	61	25	64	48	56
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	100	1	0	3	0	2	1	1	1	0	0	0	0	0	0	0
SP. DOGFISH.	7	39	0	29	0	31	28	32	39	38	30	49	100	0	32	43	29	38	36	35	35	36	33	75	52	50	46	52	56
POLLOCK.....	7	39	0	40	0	46	44	47	45	41	26	100	46	0	38	35	21	38	30	34	33	32	0	0	26	13	23	23	11
SMOOTH SKATE	29	14	25	33	100	35	25	32	43	32	100	16	17	0	26	52	13	31	24	26	18	16	0	0	39	0	33	10	11
ANGLER.....	43	39	25	38	100	46	47	32	45	100	41	33	28	0	33	57	13	46	14	22	21	16	33	25	13	25	21	19	33
WITCH.....	43	33	50	51	0	65	46	52	100	59	70	47	37	0	48	48	29	62	32	31	30	27	17	0	17	13	28	19	22
CUSK.....	57	50	50	46	0	50	40	100	48	38	48	44	28	0	32	35	21	46	24	31	28	24	33	25	30	25	31	16	0
SILVER HAKE.	64	72	50	56	100	73	100	58	59	79	52	58	35	0	48	61	26	85	26	40	37	29	50	0	22	38	41	26	44
WHITE HAKE..	79	67	75	63	0	100	67	65	77	71	67	56	35	0	52	52	24	69	34	40	34	26	17	0	26	0	28	3	11
EEL POUT....	7	0	0	2	100	0	2	0	0	3	4	0	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0
REDFISH.....	93	61	75	100	100	77	61	72	73	71	78	58	39	0	57	70	29	62	38	48	42	37	17	0	39	13	41	10	0
GRENADIER...	29	3	100	5	0	6	4	5	5	3	4	0	0	0	5	0	3	0	0	2	2	1	0	0	0	0	3	0	0
ARGENTINE...	57	100	25	35	0	46	46	45	27	41	19	33	30	0	24	22	18	23	14	24	25	18	33	0	9	25	13	13	0
LONGFIN HAKE	100	22	100	21	100	21	16	20	14	18	15	2	2	0	15	9	13	0	2	13	6	3	17	0	0	0	3	0	0

Table 32. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Summer 4W Number of Tows = 260

	LONGFIN	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	HADDOCK	THORNY SKATE	HADDOCK	COD	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	4	0	0	0	0	3	16	0	12	17	16	7	0	27	14	21	10	19	17	19	15	20	43	10	47	49	29	26	100
YELLOWTAIL..	15	19	18	16	0	31	47	7	50	58	65	27	15	62	58	44	61	62	57	71	59	68	86	90	90	85	84	100	100
L.H. SCULPIN	8	17	0	11	0	22	36	19	37	37	54	25	8	38	42	44	45	46	50	51	40	50	71	60	80	74	100	58	80
WINTER SKATE	12	5	18	8	50	5	16	4	16	11	19	7	4	19	16	26	10	35	17	22	15	21	29	20	38	100	31	24	54
SEA RAVEN...	0	3	0	6	0	7	17	7	18	17	21	9	4	27	17	21	12	23	23	21	18	22	57	20	100	38	34	26	54
SAND LAUNCE.	0	3	0	4	0	4	1	0	3	3	9	4	0	8	4	3	4	0	3	6	5	5	14	100	5	5	6	7	3
LITTLE SKATE	0	0	0	0	0	1	4	0	1	3	2	0	4	4	3	3	0	8	0	2	3	4	100	10	10	5	5	4	9
COD.....	27	30	0	39	50	39	56	52	63	56	72	65	31	69	68	62	73	73	77	73	74	100	86	80	92	90	89	84	97
HADDOCK.....	31	67	9	61	50	68	82	74	80	77	77	95	77	96	82	77	88	96	97	82	100	91	100	100	95	82	88	90	91
THORNY SKATE	46	40	55	45	50	45	52	33	63	58	81	44	42	42	59	67	51	62	57	100	56	62	43	90	75	82	77	74	77
WOLFISH.....	0	11	0	11	0	9	10	15	13	10	14	11	15	12	11	21	22	8	100	12	14	14	0	10	17	13	16	12	14
HERRING.....	4	5	0	13	0	13	13	7	14	12	16	18	31	12	12	28	6	100	7	11	12	11	29	0	15	23	13	12	14
HALIBUT.....	15	22	9	15	0	19	17	26	22	22	23	29	8	27	18	21	100	12	37	17	21	21	0	20	15	13	23	22	14
OCEAN POUT..	15	16	18	24	50	18	18	19	21	18	28	15	12	15	17	100	16	42	27	18	14	14	14	10	20	26	18	12	23
PLAICE.....	81	71	82	85	100	84	83	67	89	89	86	76	81	85	100	92	78	100	77	86	82	84	86	90	88	87	93	89	86
MACKEREL....	8	6	9	9	0	10	14	7	10	10	4	18	19	100	11	10	14	12	10	8	12	11	14	20	17	13	11	12	20
SP. DOGFISH.	15	22	9	21	0	21	15	15	10	13	2	22	100	19	10	8	4	31	13	8	10	5	14	0	3	3	2	3	0
POLLOCK.....	12	35	0	35	0	30	24	41	23	22	12	100	46	38	20	21	33	38	20	17	25	21	0	20	13	10	15	11	11
SMOOTH SKATE	23	25	18	22	50	20	23	19	25	22	100	13	4	8	23	41	27	35	27	32	21	24	14	50	30	28	33	27	26
ANGLER.....	54	51	73	55	50	64	53	48	51	100	44	45	58	42	49	54	51	54	40	47	43	38	43	40	50	33	45	49	54
WITCH.....	54	41	55	55	100	57	51	37	100	47	46	44	42	42	44	56	47	58	47	46	40	39	14	30	47	44	41	38	37
CUSK.....	27	24	27	24	0	18	12	100	10	11	9	20	15	8	9	13	14	8	13	6	10	8	0	0	5	3	5	1	0
SILVER HAKE.	62	76	55	67	50	71	100	67	72	69	61	65	88	81	60	69	51	77	50	54	59	49	86	20	63	62	57	51	69
WHITE HAKE..	85	75	82	74	50	100	51	70	58	59	37	58	88	42	43	49	41	54	33	33	35	25	14	40	20	13	25	24	9
EEL POUT....	0	2	0	3	100	1	1	0	2	1	2	0	0	0	1	3	0	0	0	1	0	1	0	0	0	3	0	0	0
REDFISH.....	88	62	91	100	100	55	36	70	42	38	32	51	65	27	33	49	24	38	30	25	23	18	0	30	13	15	9	9	0
GRENADIER...	38	10	100	13	0	8	4	11	6	7	4	0	4	4	4	5	2	0	0	4	0	0	0	0	0	5	0	1	0
ARGENTINE...	65	100	55	49	50	44	32	56	25	28	28	40	54	15	22	26	29	12	23	17	20	11	0	20	5	8	12	9	0
LONGFIN HAKE	100	27	91	29	0	21	11	26	13	12	11	5	15	8	10	10	8	4	0	8	4	4	0	0	0	8	2	3	3

Table 33. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Summer 4Vs

Number of Tows = 164

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	HADDOCK	COD	THORNY SKATE	WOLFISH	HEARTHROAT EEL	WINTER SKATE	SEA RAVEN	SAND LANCE	LITTLE SKATE	LONGHORN SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	100	36	55	95	0	86	32	14	73	41	36	32	14	0	82	0	23	9	14	86	50	45	0	32	5	9	0	100	5	0
YELLOWTAIL..	47	100	24	76	0	59	47	24	41	41	29	35	29	0	65	0	41	0	53	76	65	47	0	24	0	7	0	100	12	0
L.H. SCULPIN	80	27	100	100	0	93	40	20	80	40	40	33	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
WINTER SKATE	29	18	21	42	0	51	40	20	23	40	30	18	12	1	89	15	19	7	38	90	68	48	0	23	3	7	0	100	10	0
SEA RAVEN...	42	19	50	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
SAND LAUNCE.	77	29	41	77	0	64	28	100	59	12	17	7	33	0	93	17	27	5	33	92	59	41	0	29	6	9	0	100	14	0
LITTLE SKATE	16	7	12	24	0	17	7	0	12	7	5	6	2	0	17	0	5	0	5	17	12	7	0	5	0	0	0	100	2	0
COD.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
HADDOCK.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
THORNY SKATE	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
WOLFISH.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
HERRING.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
HALIBUT.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
OCEAN POUT..	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
PLAICE.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
MACKEREL....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
SP. DOGFISH.	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
POLLOCK.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
SMOOTH SKATE	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
ANGLER.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
WITCH.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
CUSK.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
SILVER HAKE.	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
WHITE HAKE..	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
EEL POUT....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
REDFISH.....	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
GRENADIER...	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
ARGENTINE...	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0
LONGFIN HAKE	100	41	59	100	0	83	35	24	80	40	30	21	13	0	87	0	20	0	13	87	60	47	0	27	7	7	0	100	6	0

Table 34. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Summer 4Vn

Number of Tows = 45

	LONGFIN HAKE	ARGENTINE	GREENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
YELLOWTAIL..	0	0	0	0	0	0	0	0	6	0	5	0	0	0	6	0	0	0	0	6	12	5	0	0	0	0	0	100	0
L.H. SCULPIN	0	0	0	0	0	11	0	0	9	0	11	0	0	0	15	25	0	25	0	11	6	13	0	0	50	0	100	0	0
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEA RAVEN...	0	0	0	0	0	0	0	0	3	0	5	0	0	0	6	0	0	0	0	3	0	5	0	0	100	0	20	0	0
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COD.....	45	100	50	75	100	89	100	0	81	71	89	100	100	0	97	100	0	88	89	86	100	100	0	0	100	0	100	100	0
HADDOCK.....	0	0	0	42	0	33	33	0	41	29	42	100	50	0	41	50	0	50	56	40	100	44	0	0	0	0	20	100	0
THORNY SKATE	73	100	70	67	100	61	67	0	78	86	89	50	50	100	79	75	0	75	78	100	82	77	0	0	50	0	80	100	0
WOLFISH.....	9	0	0	25	100	22	0	0	19	0	16	75	25	0	21	0	0	13	100	20	29	21	0	0	0	0	0	0	0
HERRING.....	27	0	30	21	0	28	67	0	22	14	16	25	50	0	18	75	0	100	11	17	24	18	0	0	0	0	40	0	0
HALIBUT.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCEAN POUT..	9	0	10	8	0	6	33	0	9	0	16	0	25	0	12	100	0	38	0	9	12	10	0	0	0	0	20	0	0
PLAICE.....	45	100	40	54	100	67	67	0	72	43	79	50	50	0	100	100	0	75	78	77	82	85	0	0	100	0	100	100	0
MACKEREL....	9	0	10	4	0	0	0	0	3	0	5	0	0	100	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
SP. DOGFISH.	18	0	10	17	0	17	0	0	9	0	5	25	100	0	6	25	0	25	11	6	12	10	0	0	0	0	0	0	0
POLLOCK.....	0	0	0	17	0	11	0	0	6	14	5	100	25	0	6	0	0	13	33	6	24	10	0	0	0	0	0	0	0
SMOOTH SKATE	36	100	50	42	100	39	67	0	47	57	100	25	25	100	44	75	0	38	33	49	47	44	0	0	50	0	40	50	0
ANGLER.....	36	100	40	29	0	28	33	0	19	100	21	25	0	0	9	0	0	13	0	17	12	13	0	0	0	0	0	0	0
WITCH.....	100	100	100	92	0	94	100	0	100	86	79	50	75	100	68	75	0	88	67	71	76	67	0	0	50	0	60	100	0
CUSK.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SILVER HAKE.	18	0	20	13	0	17	100	0	9	14	11	0	0	0	6	25	0	25	0	6	6	8	0	0	0	0	0	0	0
WHITE HAKE..	64	100	60	63	0	100	100	0	53	71	37	50	75	0	35	25	0	63	44	31	35	41	0	0	0	0	40	0	0
EEL POUT....	0	0	0	0	100	0	0	0	0	0	5	0	0	0	3	0	0	0	11	3	0	3	0	0	0	0	0	0	0
REDFISH.....	100	100	100	100	0	83	100	0	69	100	53	100	100	100	38	50	0	63	67	46	59	46	0	0	0	0	0	0	0
GRENADIER...	82	100	100	42	0	33	67	0	31	57	26	0	25	100	12	25	0	38	0	20	0	13	0	0	0	0	0	0	0
ARGENTINE...	9	100	10	4	0	6	0	0	3	14	5	0	0	0	3	0	0	0	0	3	0	3	0	0	0	0	0	0	0
LONGFIN HAKE	100	100	90	46	0	39	67	0	34	57	21	0	50	100	15	25	0	38	11	23	0	13	0	0	0	0	0	0	0

Table 35. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Autumn 4X Bay of Fundy Number of Tows = 78

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	WINTER SKATE	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER FL	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	100	0	0	53	67	71	73	42	48	82	48	78	75	70	58	78	100	77	100	67	71	72	95	0	89	93	83	94	100	
YELLOWTAIL..	100	0	0	11	0	19	21	17	12	18	7	17	20	30	23	20	71	19	33	16	31	23	40	0	28	30	28	100	29	
L.H. SCULPIN	100	0	0	58	67	68	69	50	24	71	41	61	78	90	48	78	86	74	100	67	67	70	95	0	81	87	100	88	79	
WINTER SKATE	100	0	0	11	33	36	37	17	4	29	14	17	44	20	19	41	57	52	33	33	41	38	60	0	49	100	49	53	50	
SEA RAVEN...	100	0	0	63	67	67	68	25	36	76	48	67	73	80	61	76	86	61	100	60	65	68	90	0	100	87	81	88	84	
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LITTLE SKATE	100	0	0	11	0	26	27	8	4	12	7	28	25	50	16	24	43	32	0	22	31	28	100	0	34	40	36	47	34	
COD.....	100	0	0	100	67	92	93	100	92	88	93	100	91	100	87	95	100	94	100	97	96	100	100	0	91	90	94	94	91	
HADDOCK.....	100	0	0	53	33	63	64	92	64	71	66	67	60	70	61	63	100	52	33	64	100	66	75	0	60	67	62	88	63	
THORNY SKATE	100	0	0	100	100	79	77	100	92	88	93	100	71	70	77	85	71	84	100	100	76	79	65	0	66	63	74	53	70	
WOLFISH.....	0	0	0	11	33	4	4	17	4	12	3	6	4	0	6	7	0	6	100	5	2	4	0	0	6	3	6	6	5	
HERRING.....	100	0	0	37	100	42	41	42	44	41	41	22	45	20	45	41	14	100	67	45	33	41	50	0	36	53	43	35	43	
HALIBUT.....	0	0	0	5	0	10	9	8	8	6	3	17	9	20	6	7	100	3	0	9	14	10	15	0	11	13	11	29	13	
OCEAN POUT..	0	0	0	63	100	56	55	50	48	76	66	67	47	60	61	100	43	55	100	60	53	55	50	0	58	57	60	47	57	
PLAICE.....	0	0	0	53	67	42	40	25	76	65	62	33	35	40	100	46	29	45	67	41	39	38	25	0	36	20	28	41	32	
MACKEREL....	0	0	0	5	0	14	13	8	12	12	7	22	13	100	13	15	29	6	0	12	14	14	25	0	15	7	17	18	13	
SP. DOGFISH.	0	0	0	58	100	70	71	50	56	82	55	56	100	70	61	63	71	81	67	67	67	70	70	0	75	80	81	65	73	
POLLOCK.....	0	0	0	42	0	25	24	42	36	24	34	100	18	40	19	29	43	13	33	31	24	25	25	0	23	10	21	18	25	
SMOOTH SKATE	0	0	0	74	67	40	39	67	80	41	100	56	29	20	58	46	14	39	33	47	39	38	10	0	26	13	23	12	25	
ANGLER.....	0	0	0	32	67	23	23	17	32	100	24	22	25	20	35	32	14	23	67	26	24	21	10	0	25	17	23	18	25	
WITCH.....	0	0	0	53	67	34	33	58	100	47	69	50	25	30	61	29	29	35	33	40	33	32	5	0	17	3	11	18	21	
CUSK.....	0	0	0	32	0	16	16	100	28	12	28	28	11	10	10	15	14	16	67	21	22	17	5	0	6	7	11	12	9	
SILVER HAKE.	100	0	0	100	100	99	100	100	100	100	100	100	96	100	97	100	100	100	100	100	98	99	100	0	96	93	98	94	98	
WHITE HAKE..	100	0	0	100	100	100	96	100	100	100	100	100	93	100	100	100	100	100	100	100	94	94	95	0	92	87	94	82	93	
EEL POUT....	0	0	0	5	100	4	4	0	8	12	7	0	5	0	6	7	0	10	33	5	2	3	0	0	4	3	4	0	4	
REDFISH.....	0	0	0	100	33	26	25	50	40	35	48	44	20	10	32	29	14	23	67	33	20	27	10	0	23	7	21	12	18	
GRENADIER...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ARGENTINE...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LONGFIN HAKE	100	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3	0	2	2	1	5	0	2	3	2	6	2	

Table 36. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Autumn 4X excluding Bay of Fundy Number of Tows = 172

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	1	0	4	8	3	0	4	4	9	23	0	4	14	11	24	14	10	9	12	19	0	19	30	13	22	100
YELLOWTAIL..	0	14	0	19	0	24	42	22	30	42	26	35	63	33	40	43	54	59	41	37	40	46	81	0	48	87	58	100	93
L.H. SCULPIN	11	19	14	42	0	31	41	42	30	34	56	50	42	83	41	57	65	71	71	43	44	52	71	0	90	57	100	64	60
WINTER SKATE	5	14	0	4	0	12	12	14	11	15	15	13	23	0	13	10	17	29	14	14	14	16	29	0	16	100	18	31	47
SEA RAVEN...	0	10	0	22	0	7	15	28	9	9	11	32	16	33	15	38	35	47	47	20	19	24	19	0	100	22	39	23	40
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LITTLE SKATE	11	14	0	6	0	12	19	14	9	15	15	13	19	17	14	29	28	41	20	16	19	21	100	0	19	39	31	39	40
COD.....	26	33	14	67	0	50	60	72	59	55	59	81	77	100	71	81	83	94	98	72	77	100	84	0	97	87	92	89	100
HADDOCK.....	53	76	43	92	0	86	91	92	91	85	78	99	93	100	94	95	98	100	98	92	100	99	97	0	100	100	99	100	100
THORNY SKATE	74	62	86	69	100	74	71	75	80	72	85	69	65	50	71	86	63	76	69	100	63	63	58	0	71	65	66	64	73
WOLFISH.....	5	7	14	35	0	19	25	42	32	25	26	47	21	33	28	43	46	53	100	31	30	38	32	0	74	30	49	31	47
HERRING.....	0	2	0	10	0	12	13	0	16	15	7	15	14	33	12	24	11	100	18	12	11	13	23	0	26	22	17	16	27
HALIBUT.....	5	21	14	19	0	15	22	28	16	30	19	28	28	33	26	19	100	29	43	26	28	30	42	0	52	35	42	39	33
OCEAN POUT..	11	12	14	18	0	14	13	19	18	11	15	18	14	17	12	100	9	29	18	16	13	14	19	0	26	9	17	14	20
PLAICE.....	63	60	71	64	100	73	65	58	89	85	70	54	49	67	100	52	54	65	55	61	56	54	42	0	45	52	55	59	27
MACKEREL....	0	0	0	5	0	3	2	0	2	4	7	3	0	100	4	5	4	12	4	3	4	5	3	0	6	0	7	3	0
SP. DOGFISH.	26	19	0	17	0	20	25	14	16	23	22	25	100	0	22	29	26	35	18	25	25	26	26	0	23	43	25	42	67
POLLOCK.....	11	31	0	52	0	39	40	58	52	32	33	100	40	33	39	57	41	59	65	43	42	44	29	0	71	39	48	38	40
SMOOTH SKATE	37	19	29	19	0	28	21	25	36	21	100	13	14	33	20	19	11	12	14	21	13	13	13	0	10	17	21	11	7
ANGLER.....	58	48	57	40	100	50	43	14	61	100	41	25	28	33	47	29	35	47	27	35	28	23	26	0	16	35	25	34	13
WITCH.....	32	29	43	40	100	46	40	19	100	51	59	34	16	17	41	38	15	41	29	32	25	21	13	0	13	22	18	20	0
CUSK.....	37	38	29	28	100	28	22	100	16	9	33	31	12	0	22	33	22	0	31	25	21	21	16	0	32	22	21	13	7
SILVER HAKE.	84	88	86	72	100	93	100	64	95	87	81	62	60	33	73	67	50	82	53	68	60	51	65	0	52	57	61	69	53
WHITE HAKE..	89	83	86	60	100	100	65	58	77	70	78	43	35	33	57	48	24	53	29	50	40	30	29	0	16	39	32	28	20
EEL POUT....	5	2	14	1	100	1	1	3	2	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
REDFISH.....	68	64	86	100	100	68	57	64	75	62	59	63	33	67	56	71	35	47	59	52	47	45	16	0	58	13	49	25	7
GRENADIER...	37	17	100	7	100	8	6	6	7	8	7	0	0	0	5	5	2	0	2	5	2	1	0	0	0	0	1	0	0
ARGENTINE...	95	100	100	33	100	47	35	44	27	38	30	19	19	0	26	24	20	6	6	24	20	11	19	0	13	26	11	9	0
LONGFIN HAKE	100	43	100	16	100	23	15	19	14	21	26	3	12	0	13	10	2	0	2	13	6	4	6	0	0	4	3	0	0

Table 37. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Autumn 4W Number of Tows = 264

	LONG FIN	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	HADDOCK	COD	WOLFISH	THORNY SKATE	SEA RAVEN	SAND LAUNCE	SKATE	WINTER SKATE	LITTLE SKATE	YELLOWTAIL	WINTER FL
WINTER FL...	5	4	7	3	0	12	17	3	5	20	9	6	24	52	10	10	11	38	13	13	18	20	50	0	42	38	30	28	100
YELLOWTAIL..	19	6	21	15	0	32	45	6	42	58	62	23	33	64	51	30	59	72	43	55	59	65	100	100	87	95	89	100	97
L.H. SCULPIN	12	9	14	13	0	27	37	10	35	43	47	24	24	52	38	30	48	58	35	43	43	51	80	75	74	92	100	66	77
WINTER SKATE	2	0	0	1	0	11	15	0	12	18	16	5	0	32	12	10	20	25	13	16	17	20	20	25	38	100	37	28	38
SEA RAVEN...	2	2	0	4	0	14	19	3	13	22	21	10	10	36	17	20	16	42	26	22	22	27	50	25	100	50	39	34	56
SAND LAUNCE.	0	0	0	0	0	1	2	0	0	1	1	2	0	0	2	0	2	0	0	1	1	2	0	100	2	3	3	3	0
LITTLE SKATE	0	0	0	1	0	3	4	0	3	4	1	1	0	0	3	0	2	17	4	1	5	5	100	0	9	5	8	7	13
COD.....	21	20	14	46	0	52	60	42	61	60	68	60	71	92	66	73	84	95	70	73	78	100	100	75	94	92	91	88	95
HADDOCK.....	31	57	14	66	0	74	78	68	71	76	76	87	86	96	78	93	89	88	78	78	100	90	100	75	89	90	90	91	95
THORNY SKATE	67	52	86	70	0	60	60	58	71	68	81	57	38	48	67	80	70	58	74	100	62	66	20	50	68	65	70	68	54
WOLFISH.....	2	2	0	13	0	8	9	10	14	6	12	18	5	8	10	17	11	10	100	10	9	9	10	0	11	8	8	7	8
HERRING.....	0	0	0	11	0	22	18	3	15	18	7	20	24	32	14	27	9	100	17	14	17	21	70	0	32	25	23	21	38
HALIBUT.....	14	9	21	12	0	15	15	29	18	20	25	18	14	20	17	23	100	10	22	19	18	20	10	25	13	22	21	19	13
OCEAN POUT..	7	13	0	18	0	19	14	19	13	12	9	23	19	16	11	100	16	20	22	14	13	12	0	0	11	8	9	7	8
PLAICE.....	88	81	79	89	0	81	80	68	95	82	96	85	71	52	100	80	82	72	91	85	77	76	60	100	66	63	79	79	54
MACKEREL....	5	7	0	8	0	12	11	6	8	12	4	12	19	100	6	13	11	20	9	7	11	13	0	0	17	20	13	12	33
SP. DOGFISH.	12	11	0	6	0	12	9	23	6	8	9	12	100	16	7	13	7	13	4	5	9	8	0	0	4	0	5	5	13
POLLOCK.....	26	46	7	49	0	49	37	45	36	32	18	100	48	40	34	63	34	42	65	29	35	27	10	50	15	10	20	14	13
SMOOTH SKATE	38	22	57	27	0	20	24	29	33	32	100	14	29	12	31	20	39	13	35	33	25	25	10	25	26	27	32	31	15
ANGLER.....	67	57	86	44	0	60	49	45	53	100	53	43	43	56	44	47	52	52	30	46	41	37	50	25	47	52	49	49	59
WITCH.....	57	56	71	56	0	56	48	35	100	51	53	48	33	36	50	47	45	40	65	47	37	37	30	0	26	32	39	34	15
CUSK.....	31	30	50	19	0	19	15	100	10	12	13	17	33	8	10	20	20	3	13	11	10	7	0	0	2	0	3	1	3
SILVER HAKE.	93	94	86	87	0	95	100	87	82	81	66	81	76	80	70	87	64	82	70	67	69	62	80	75	66	70	67	62	82
WHITE HAKE..	79	78	79	67	0	100	58	71	58	60	34	67	67	56	44	73	39	63	39	41	40	32	30	25	30	30	31	27	36
EEL POUT....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDFISH.....	79	72	100	100	0	54	44	58	47	36	37	55	29	28	40	57	25	25	52	39	29	24	10	0	8	3	12	10	8
GRENADIER...	33	20	100	15	0	10	6	23	9	11	12	1	0	0	5	0	7	0	0	7	1	1	0	0	0	0	2	2	3
ARGENTINE...	60	100	79	42	0	37	27	52	27	27	18	30	29	16	21	23	11	0	4	17	15	6	0	0	2	0	5	2	5
LONGFIN HAKE	100	46	100	35	0	29	21	42	22	25	24	13	24	8	18	10	14	0	4	17	6	5	0	0	2	3	5	6	5

Table 38. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Autumn 4Vs Number of Tows = 154

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	SAND LAUNCE	SEA RAVEN	LITTLE SKATE	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOWTAIL..	9	10	4	12	0	16	35	0	19	29	33	24	0	57	35	8	18	54	14	40	56	37	50	88	90	63	90	100	0
L.H. SCULPIN	6	0	4	5	0	6	22	0	6	14	19	9	0	29	13	8	14	31	11	16	21	14	0	75	40	43	100	35	0
WINTER SKATE	9	0	8	9	0	16	28	0	11	29	29	12	50	14	14	0	36	15	11	17	23	15	0	25	40	100	48	28	0
SEA RAVEN...	0	0	0	1	0	2	7	0	4	5	7	0	0	0	6	0	9	0	3	8	11	7	0	0	100	17	19	17	0
SAND LAUNCE.	0	0	0	3	0	0	7	0	1	0	2	3	0	0	5	0	0	8	3	6	8	5	50	100	0	9	29	13	0
LITTLE SKATE	0	0	0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	2	3	1	100	13	0	0	0	2	0
COD.....	73	80	68	88	100	76	87	100	83	86	81	100	100	86	88	69	91	85	94	88	96	100	100	88	100	91	90	93	0
HADDOCK.....	42	50	36	38	0	43	58	100	40	48	57	61	100	57	48	8	68	77	33	53	100	53	100	75	80	74	76	78	0
THORNY SKATE	70	60	76	78	50	73	80	100	81	71	83	88	100	71	84	69	91	100	83	100	91	84	100	100	100	96	95	94	0
WOLFISH.....	27	10	16	36	0	24	18	0	28	19	14	33	50	29	25	38	27	8	100	23	16	25	0	13	10	17	19	9	0
HERRING.....	0	0	0	5	0	0	5	0	8	0	14	12	0	14	9	8	0	100	3	10	13	8	0	13	0	9	19	13	0
HALIBUT.....	39	40	36	17	0	37	30	50	18	33	21	15	50	0	14	8	100	0	17	16	20	15	0	0	20	35	14	7	0
OCEAN POUT..	6	10	4	13	0	8	7	0	12	5	7	3	0	14	9	100	5	8	14	7	1	7	0	0	0	0	5	2	0
PLAICE.....	91	70	84	92	100	90	95	50	100	81	100	91	100	86	100	100	91	100	100	95	93	94	100	100	90	87	90	94	0
MACKEREL....	6	10	4	4	0	4	5	0	4	5	2	6	0	100	4	8	0	8	6	4	5	4	0	0	0	4	10	7	0
SP. DOGFISH.	6	0	4	3	0	2	2	0	2	5	5	3	100	0	1	0	5	0	3	2	3	1	0	0	0	4	0	0	0
POLLOCK.....	27	50	28	30	0	29	22	50	18	19	21	100	50	29	21	8	23	31	31	22	27	24	0	13	0	17	14	15	0
SMOOTH SKATE	42	30	32	32	100	43	38	0	34	24	100	27	100	14	29	23	41	46	17	27	32	25	0	13	30	52	38	26	0
ANGLER.....	24	10	36	16	50	29	27	0	16	100	12	12	50	14	12	8	32	0	11	12	13	13	0	0	10	26	14	11	0
WITCH.....	85	30	76	70	100	78	65	0	100	62	67	45	100	43	57	77	68	54	64	52	44	51	50	13	30	39	24	30	0
CUSK.....	3	10	0	3	0	2	2	100	0	0	0	3	0	0	1	0	5	0	0	2	3	1	0	0	0	0	0	0	0
SILVER HAKE.	61	60	68	45	100	67	100	50	47	76	55	39	50	43	39	31	82	23	31	37	47	38	50	50	40	74	62	39	0
WHITE HAKE..	85	90	96	50	100	100	55	50	46	67	50	42	50	29	30	31	82	0	33	28	28	27	0	0	10	35	14	15	0
EEL POUT....	0	0	0	1	100	4	3	0	2	5	5	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0
REDFISH.....	94	100	96	100	50	78	57	100	64	57	57	70	100	43	48	77	59	31	75	46	39	49	0	25	10	30	19	17	0
GRENADIER...	64	60	100	32	0	49	28	0	23	43	19	21	50	14	14	8	41	0	11	15	12	13	0	0	0	9	5	2	0
ARGENTINE...	15	100	24	13	0	18	10	50	4	5	7	15	0	14	5	8	18	0	3	5	7	6	0	0	0	0	0	2	0
LONGFIN HAKE	100	50	84	41	0	57	33	50	34	38	33	27	100	29	21	15	59	0	25	18	19	18	0	0	0	13	10	6	0

Table 39. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Autumn 4Vn

Number of Tows = 39

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	4	0	8	11	0	0	0	9	8	0	0	6	25	50	7	15	7	13	6	0	0	33	0	0	100	100
YELLOWTAIL..	0	0	0	0	0	4	11	0	0	0	0	0	0	0	3	0	50	7	8	4	7	3	0	0	33	0	0	100	50
L.H. SCULPIN	0	0	0	4	0	4	11	0	0	0	0	8	0	0	0	0	0	7	8	4	7	3	0	0	33	0	100	0	0
WINTER SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	0	0	0	100	0	0	0
SEA RAVEN...	0	0	0	4	0	12	22	0	0	0	9	17	0	0	6	25	50	21	15	11	13	10	0	0	100	0	100	100	50
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	7	0	4	0	3	0	100	0	0	0	0	0
LITTLE SKATE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COD.....	36	100	50	71	0	80	89	0	70	75	82	100	0	100	84	100	100	100	100	85	100	100	0	100	100	100	100	100	100
HADDOCK.....	18	0	17	42	0	52	56	0	40	25	45	50	0	33	38	75	100	29	92	41	100	48	0	0	67	0	100	100	100
THORNY SKATE	64	0	58	58	0	64	67	0	65	75	73	83	0	67	75	100	100	79	77	100	73	74	0	100	100	0	100	100	100
WOLFISH.....	9	0	8	33	0	40	44	0	30	0	27	58	0	67	28	50	100	29	100	37	80	42	0	0	67	0	100	100	100
HERRING.....	9	0	8	21	0	32	56	0	15	0	18	50	0	100	34	50	50	100	31	41	27	45	0	100	100	0	100	100	50
HALIBUT.....	0	0	0	4	0	8	11	0	5	0	9	0	0	0	6	0	100	7	15	7	13	6	0	0	33	0	0	100	50
OCEAN POUT..	0	0	0	8	0	16	0	0	0	0	27	25	0	0	13	100	0	14	15	15	20	13	0	0	33	0	0	0	50
PLAICE.....	73	100	75	79	0	84	78	0	80	100	91	67	0	33	100	100	100	79	69	89	80	87	0	100	67	100	0	100	100
MACKEREL....	0	0	0	0	0	4	0	0	0	0	0	25	0	100	3	0	0	21	15	7	7	10	0	0	0	0	0	0	0
SP. DOGFISH.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLLOCK.....	0	0	8	25	0	32	22	0	15	25	27	100	0	100	25	75	0	43	54	37	40	39	0	0	67	0	100	0	50
SMOOTH SKATE	27	100	33	25	0	32	11	0	30	50	100	25	0	0	31	75	50	14	23	30	33	29	0	0	33	0	0	0	50
ANGLER.....	18	100	25	17	0	16	22	0	15	100	18	8	0	0	13	0	0	0	0	11	7	10	0	0	0	0	0	0	0
WITCH.....	91	0	83	71	0	64	78	0	100	75	55	25	0	0	50	0	50	21	46	48	53	45	0	0	0	0	0	0	0
CUSK.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SILVER HAKE.	36	0	25	33	0	36	100	0	35	50	9	17	0	0	22	0	50	36	31	22	33	26	0	0	67	0	100	100	50
WHITE HAKE..	82	100	83	83	0	100	100	0	80	100	73	67	0	33	66	100	100	57	77	59	87	65	0	0	100	0	100	100	100
EEL POUT....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDFISH.....	100	100	100	100	0	80	89	0	85	100	55	50	0	0	59	50	50	36	62	52	67	55	0	0	33	0	100	0	50
GRENADIER...	91	100	100	50	0	40	33	0	50	75	36	8	0	0	28	0	0	7	8	26	13	19	0	0	0	0	0	0	0
ARGENTINE...	0	100	8	4	0	4	0	0	0	25	9	0	0	0	3	0	0	0	0	0	0	3	0	0	0	0	0	0	0
LONGFIN HAKE	100	0	83	46	0	36	44	0	50	50	27	0	0	0	25	0	0	7	8	26	13	13	0	0	0	0	0	0	0

Table 40. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Spring 4X Bay of Fundy Number of Tows = 58

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	SAND LAUNCE	LITTLE SKATE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	0	0	0	79	0	92	82	60	85	100	92	88	100	0	86	95	88	91	93	88	82	87	100	0	94	100	91	100	100
YELLOWTAIL..	0	0	0	14	0	15	6	0	20	0	38	46	0	0	41	36	44	33	43	35	41	31	35	0	37	50	36	100	37
L.H. SCULPIN	0	0	0	93	0	85	76	80	85	50	100	96	100	0	92	92	100	85	100	91	91	91	95	0	94	96	100	100	94
WINTER SKATE	0	0	0	21	0	23	12	40	30	0	50	33	0	0	35	51	50	33	43	40	27	46	70	0	51	100	47	68	51
SEA RAVEN...	0	0	0	86	0	77	71	40	70	50	88	92	50	0	86	95	88	88	93	86	86	89	95	0	100	100	91	100	94
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LITTLE SKATE	0	0	0	7	0	31	18	40	20	0	33	21	0	0	24	36	25	36	21	28	14	33	100	0	37	54	36	37	39
COD.....	0	0	0	100	0	92	94	100	85	100	92	96	50	0	89	97	100	88	100	93	100	100	90	0	94	96	92	89	92
HADDOCK.....	0	0	0	36	0	54	47	80	40	100	33	54	0	0	43	41	56	39	57	47	100	41	15	0	37	23	38	47	35
THORNY SKATE	0	0	0	93	0	92	88	100	85	100	88	83	100	0	86	77	75	70	86	100	91	74	60	0	73	65	74	79	75
WOLFISH.....	0	0	0	43	0	8	18	40	25	0	29	38	50	0	35	31	25	15	100	28	36	26	15	0	25	23	26	32	25
HERRING.....	0	0	0	43	0	69	65	40	65	100	46	42	100	0	57	51	56	100	36	53	59	54	60	0	57	42	53	58	59
HALIBUT.....	0	0	0	21	0	38	29	40	30	50	21	25	50	0	32	28	100	27	29	28	41	30	20	0	27	31	30	37	27
OCEAN POUT..	0	0	0	64	0	69	59	60	55	100	67	71	50	0	62	100	69	61	86	70	73	70	70	0	73	77	68	74	73
PLAICE.....	0	0	0	79	0	85	82	60	90	50	75	79	100	0	100	59	75	64	93	74	73	61	45	0	63	50	64	79	63
MACKEREL....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SP. DOGFISH.	0	0	0	7	0	0	6	0	5	0	4	0	100	0	5	3	6	6	7	5	0	2	0	0	2	0	4	0	4
POLLOCK.....	0	0	0	57	0	31	41	20	30	0	38	100	0	0	51	44	38	30	64	47	59	43	25	0	43	31	43	58	41
SMOOTH SKATE	0	0	0	50	0	46	47	20	55	0	100	38	50	0	49	41	31	33	50	49	36	41	40	0	41	46	45	47	43
ANGLER.....	0	0	0	0	0	15	12	20	10	100	0	0	0	0	3	5	6	6	0	5	9	4	0	0	2	0	2	0	4
WITCH.....	0	0	0	36	0	77	82	80	100	100	46	25	50	0	49	28	38	39	36	40	36	31	20	0	27	23	32	21	33
CUSK.....	0	0	0	7	0	23	18	100	20	50	4	4	0	0	8	8	13	6	14	12	18	9	10	0	4	8	8	0	6
SILVER HAKE.	0	0	0	43	0	69	100	60	70	100	33	29	50	0	38	26	31	33	21	35	36	30	15	0	24	8	25	5	27
WHITE HAKE..	0	0	0	43	0	100	53	60	50	100	25	17	0	0	30	23	31	27	7	28	32	22	20	0	20	12	21	11	24
EEL POUT....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDFISH.....	0	0	0	100	0	46	35	20	25	0	29	33	50	0	30	23	19	18	43	30	23	26	5	0	24	12	25	11	22
GRENADIER...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ARGENTINE...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONGFIN HAKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 41. GROUNDFISH SPECIES ASSOCIATION MATRIX (PERCENTAGE OF CO-OCCURRENCES)

1980-84 Spring 4X excluding Bay of Fundy Number of Tows = 143

	LONGFIN HAKE	ARGENTINE	GRENADIER	REDFISH	EEL POUT	WHITE HAKE	SILVER HAKE	CUSK	WITCH	ANGLER	SMOOTH SKATE	POLLOCK	SP. DOGFISH	MACKEREL	PLAICE	OCEAN POUT	HALIBUT	HERRING	WOLFISH	THORNY SKATE	HADDOCK	COD	LITTLE SKATE	SAND LAUNCE	SEA RAVEN	WINTER SKATE	L.H. SCULPIN	YELLOWTAIL	WINTER FL
WINTER FL...	100	91	9	100	0	91	100	100	45	45	45	100	82	18	64	9	9	18	9	82	65	73	79	9	0	11	9	0	0	0
YELLOWTAIL..	27	100	5	43	0	73	84	100	49	43	35	92	81	19	70	19	27	38	24	81	69	78	100	16	11	7	40	8	0	0
L.H. SCULPIN	50	100	100	0	0	100	100	70	100	50	26	100	50	11	79	23	30	47	47	95	79	0	40	21	0	0	18	0	0	0
WINTER SKATE	11	100	0	52	0	47	63	47	56	39	26	70	28	11	84	23	30	47	68	68	79	0	0	21	7	0	40	0	0	0
SEA RAVEN...	50	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	10	0	19	0	0	0
SAND LAUNCE.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LITTLE SKATE	100	100	0	100	0	100	100	100	100	50	26	100	50	11	79	23	30	47	68	68	79	0	0	21	7	0	40	0	0	0
COD.....	100	100	100	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
HADDOCK.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
THORNY SKATE	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
WOLFISH.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
HERRING.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
HALIBUT.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
OCEAN POUT..	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
PLAICE.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
MACKEREL....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
SP. DOGFISH.	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
POLLOCK.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
SMOOTH SKATE	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
ANGLER.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
WITCH.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
CUSK.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
SILVER HAKE.	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
WHITE HAKE..	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
EEL POUT....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
REDFISH.....	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
GRENADIER...	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
ARGENTINE...	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0
LONGFIN HAKE	100	100	0	100	0	100	100	100	100	50	28	70	28	12	88	26	32	40	47	95	79	0	0	21	7	0	40	0	0	0

Table 42. Co-occurrence indices for each fish species by area and season from groundfish research trawl surveys of the Scotian Shelf and Bay of Fundy, 1980-84. Sp = spring; Sm = summer; A = autumn.

Scale: Group	Points
0	0
1-9	1
10-24	2
25-49	3
50-100	5

	Bay of Fundy			4X excl. Bay of Fundy			4W			4Vs			4Vn			Average				
	Sp	Sm	A	Sp	Sm	A	Sp	Sm	A	Sp	Sm	A	Sp	Sm	A	Bay of Fundy	4X	4W	4Vs	4Vn
Winter flounder	68	59	68	25	21	21	13	26	29	0	0	0	0	0	16	65	22	23	0	5
Yellowtail fl.	40	31	36	37	31	42	44	48	48	48	37	36	0	6	11	36	37	47	40	6
Longhorn sculpin	69	69	67	43	38	43	45	43	45	38	27	27	12	10	11	68	41	44	31	11
Winter skate	42	32	46	32	22	27	32	31	26	44	38	28	12	0	2	40	27	30	37	5
Sea raven	68	70	67	31	29	31	32	30	29	24	18	15	23	6	16	68	30	30	19	15
Sand lance	0	17	0	12	14	0	14	18	8	13	19	15	0	0	4	6	9	13	16	1
Little skate	35	30	37	12	22	31	20	12	14	6	8	9	0	0	0	34	22	15	8	0
Cod	71	78	79	69	53	56	58	54	54	62	57	55	47	42	53	76	59	55	58	47
Haddock	65	77	58	72	65	69	62	60	62	50	40	43	23	28	38	67	69	61	44	39
Thorny skate	67	72	70	57	55	57	52	52	52	65	54	55	36	45	49	70	56	52	58	43
Wolffish	34	40	22	46	43	39	26	24	21	42	36	32	21	19	34	32	43	24	37	25
Herring	53	50	45	45	23	25	30	26	27	18	18	16	25	23	33	49	31	28	17	27
Halibut	36	20	22	45	33	36	41	32	30	26	25	29	0	0	14	26	38	34	27	5
Ocean pout	62	63	58	31	30	29	25	29	26	20	19	20	19	14	16	61	30	27	20	13
Plaice	62	57	47	65	56	51	64	61	61	63	56	59	40	44	52	55	57	62	59	45
Mackerel	0	15	28	21	6	19	24	26	24	0	11	20	0	6	8	14	15	25	7	5
Spiny dogfish	13	63	68	45	40	32	39	21	22	20	21	16	0	14	0	48	39	27	19	5
Pollock	44	47	36	63	37	44	42	32	37	41	23	29	38	12	28	42	48	37	31	26
Smooth skate	47	36	44	40	32	31	41	34	36	44	36	34	25	33	28	42	34	37	38	29
Angler	14	30	35	43	37	42	47	48	47	38	25	27	18	18	16	26	37	47	30	17
Witch	42	48	46	49	39	35	52	43	43	59	48	47	34	47	34	45	41	46	51	38
Cusk	20	15	27	49	34	33	28	23	22	19	17	12	0	0	0	21	39	24	16	0
Silver hake	37	55	78	53	46	55	54	49	60	34	34	45	18	13	29	57	51	53	38	20
White hake	35	71	80	46	44	45	43	41	43	44	30	38	32	34	51	62	45	42	37	38
Eelpout	0	13	18	1	9	11	12	3	0	0	5	9	0	5	0	10	7	5	5	2
Redfish	34	30	37	49	46	49	45	37	39	44	42	43	34	35	43	34	48	40	43	37
Grenadier	0	0	0	15	15	18	20	14	15	28	22	29	0	22	27	0	16	16	26	16
Argentine	0	14	0	39	34	33	40	33	29	30	20	19	0	10	7	5	35	34	23	6
Longfin hake	0	0	12	22	21	24	31	21	27	33	28	30	0	24	23	4	22	26	30	16
Average	37	41	39	40	34	36	36	34	34	33	28	26	15	18	19					

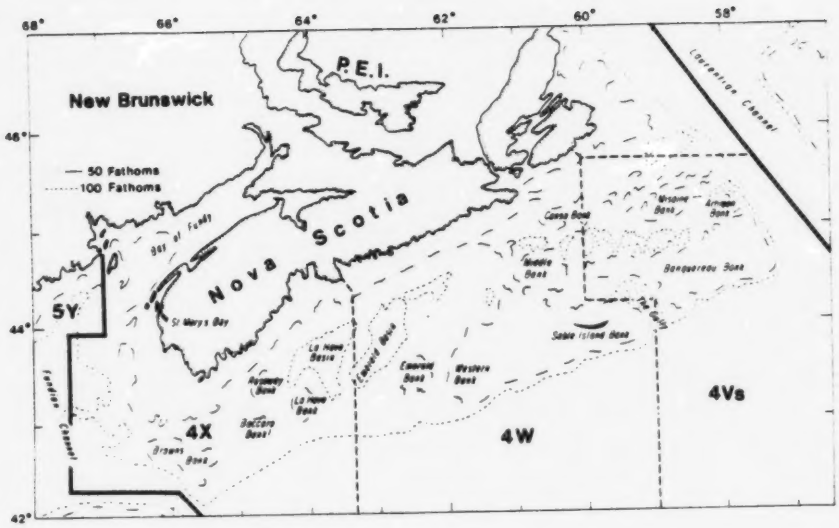


Fig. 1. Map of Scotian Shelf and Bay of Fundy area with Northwest Atlantic Fisheries Organization (NAFO) Divisions and Subdivisions.

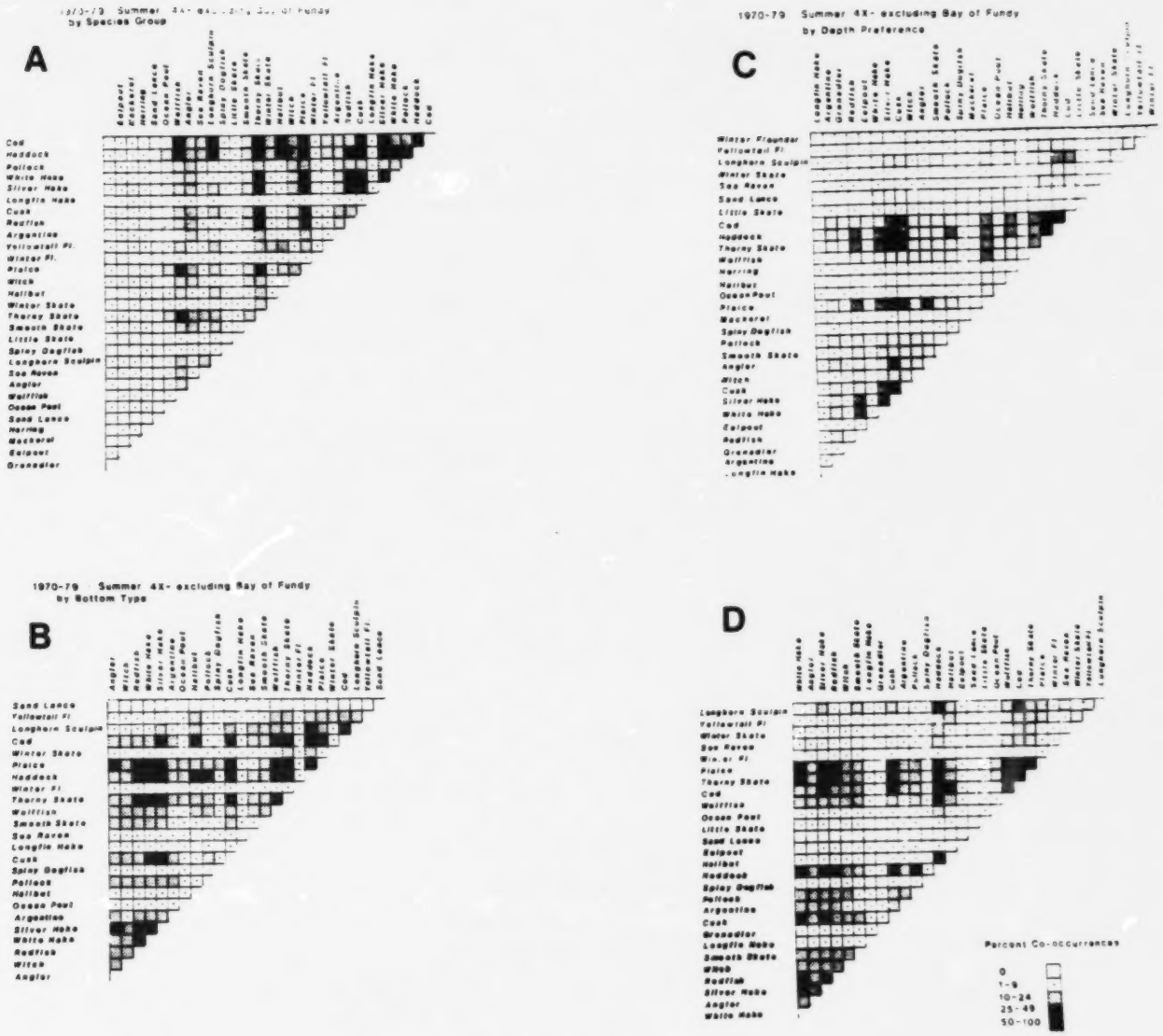
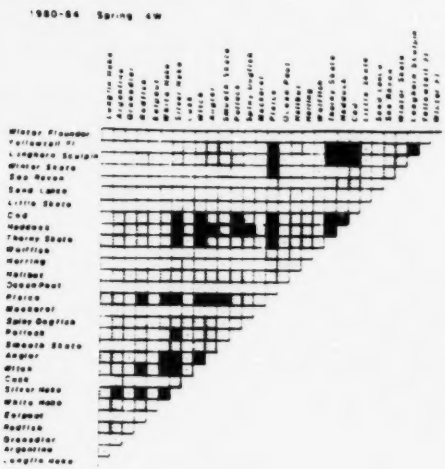
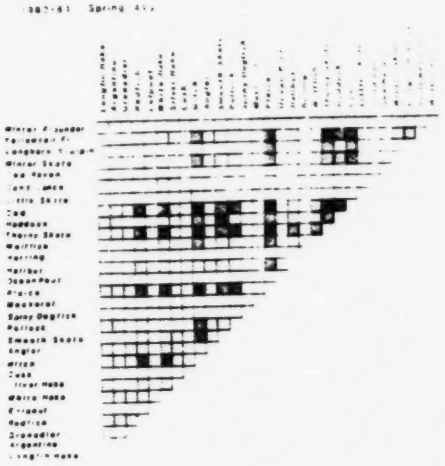


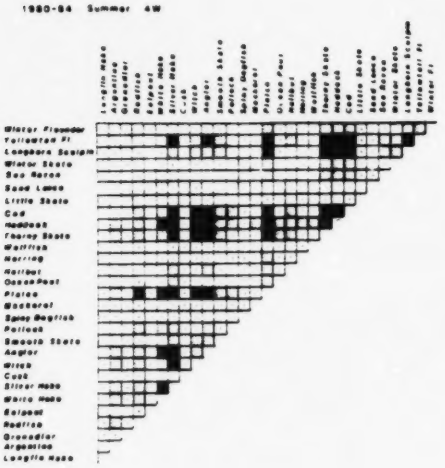
Fig. 2. Graphic matrices of fish species co-occurrences from groundfish research trawl surveys of the Scotian Shelf and Bay of Fundy 1970-79 with species listed in order of: A - species group; B - bottom type; C - depth preference; D - Mahon et al. 1984.

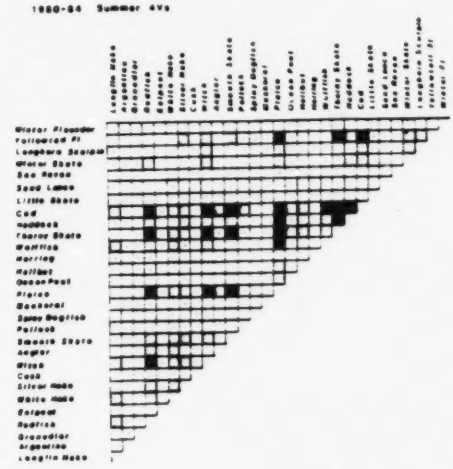
Fig. 3. Graphic matrices of fish species co-occurrences from groundfish research trawl surveys of the Scotian Shelf and Bay of Fundy 1980-84 in subareas (NAFO Divisions and Subdivisions): (A) - Bay of Fundy, (B) - 4X excluding Bay of Fundy, (C) - 4W, (D) - 4Vs, (E) - 4Vn.

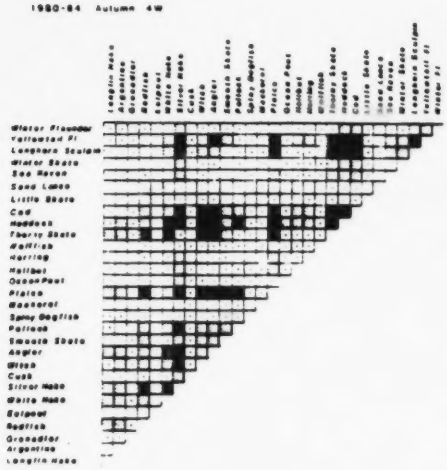
Fig. 3. (cont'd.)

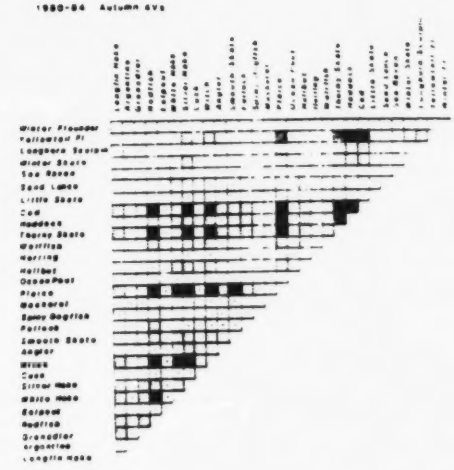








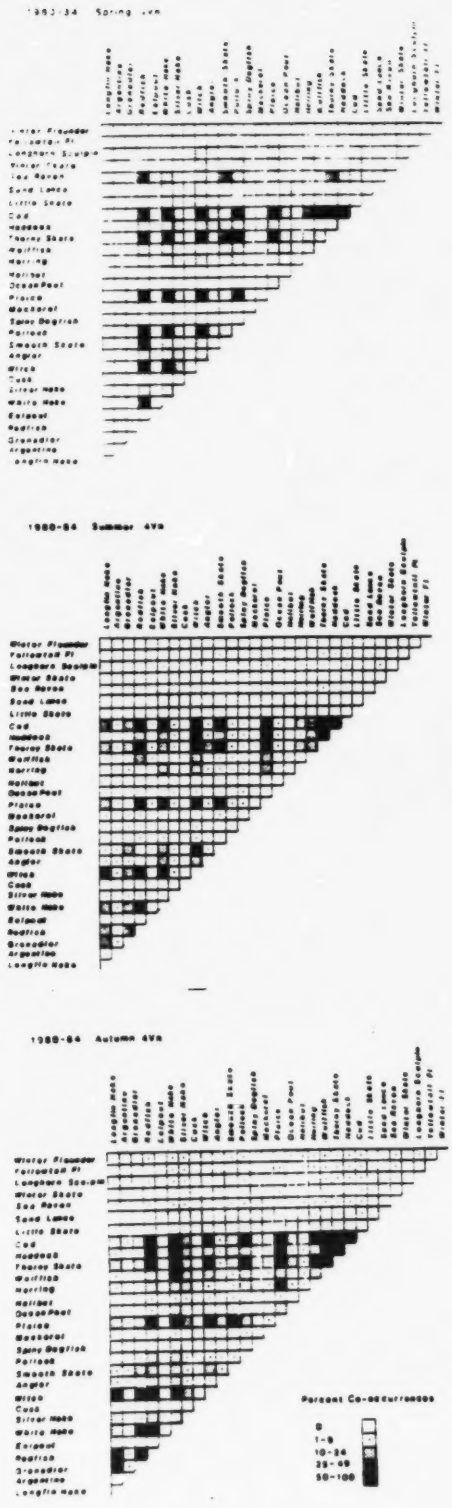




3C

3D

Fig. 3. (cont'd.)



3E